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Fredric C. Lynch

FREDRIC C. LYNCH, Major, USAF
Director of Public Affairs
Air Force Institute of Technology (ATC)
Wright-Patterson AFB, OH 45433

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A STUDY OF RESEARCH AND DEVELOPMENT CONTRACT

REQUIREMENTS AND THEIR GROWTH

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A STUDY OF RESEARCH AND DEVELOPMENT CONTRACT REQUIREMENTS AND THEIR GROWTH

by

RONALD GENE BLACKLEDGE, B.S., M.S.

DISSERTATION

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

DOCTOR OF PHILOSOPHY

THE UNIVERSITY OF TEXAS AT AUSTIN

May 1979

DEDICATION

This dissertation is dedicated to my parents, Roscoe and Betty, whose loving and consistant pressure towards excellance was only recognized after leaving home, and to my wife, Lillian, whose restless search for fulfillment brought us both to an adult relationship with God.

A STUDY OF RESEARCH AND DEVELOPMENT CONTRACT
REQUIREMENTS AND THEIR GROWTH

Publication No.

Ronald Gene Blackledge, Ph.D.
The University of Texas at Austin, 1979

Supervising Professor: Eugene B. Konecci, Ph.D.

Military contracts for the development and procurement of weapon systems and associated hardware components deal with definitional statements concerning those products called technical requirements. Conceptually, there are different types of technical requirements which range from broad goals stated in Mission Requirements, to subtle and small details reflected in Design Requirements.

This dissertation was a pilot study on technical requirements and was split into two parts. The first part investigated documents which commonly reflect requirements in Air Force developments. The document type chosen was the Part One Critical Item Specification. The intent of this part of the research was to see if proposed conceptual requirement types could be found in

standard documents, and if so, whether the types fully exhausted the document's supply of requirements. Study results indicated that the proposed categories were appropriate but that the overlap between requirement types made isolation a gross rather than precise process. Recommendations for future study of this area included proposal for a small group investigation of requirement counting and classifying.

The second part of the study was to investigate the relationship between the requirement categories. A common belief in military development circles is that there is an orderly growth evidenced in requirement types through a project's development life cycle. All requirement types are known to grow with time. Depending on the requirement type, it is believed that some grow faster than others and that this growth is predictable. Data were analyzed and a growth model consistant with the results was proposed. Recommendations for future study included the specific areas to be emphasized in confirming this proposed growth pattern.

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CHAPTER ONE - HISTORICAL BACKGROUND

Introduction

Since man first shaped a stone into a wheel, he has pursued an increasingly complex process of sorting and analyzing his steps and their consequences. Ironically, perhaps, the process has received the most sophisticated attention in one of the areas that most affects man's short-run survival - - the development of weapons. This dissertation deals with complex weapons and associated equipment as they are developed by the United States Air Force in conjunction with American aerospace companies.

The specific focus is on requirements, a term much used in weapon system acquisition, but one which is quite ambiguously defined. A key objective is to more rigorously study the term "requirement" to identify a taxonomy of requirement types present in the weapon acquisition process. Each requirement type is evaluated for its potential to be isolated and counted using standard documents of the development process. Finally, relationships between the initial numbers of requirements in each category and those numbers at some common conceptual point later in the development cycle are investigated.

Definition of a Requirement

A requirement is "something wanted or needed" as defined by Webster. The weapons acquisition process has evolved more constraints on this basic definition. Although this modified definition is not legitimized by the Air Force in a formal glossary, it is commonly accepted in practise:

> A requirement is a formally expressed goal whose outcome can be individually verified.

This simple definition carries some background elements with it generated by the unique environment. First, a requirement is understood to be a formal expression. This means it must be written or recorded so as to be available for verification of its various terms. It also means that it must be transmitted from one party to another in a commonly accepted format. A specification document is a common American convention for transmitting requirements. The outcome of a requirement must be independently verified upon completion. This can be in the form of a test, an analysis, or an inspection. Exhibit One gives a typical specification format.

AN/ARN-1000 SPECIFICATIONS

1. The AR/ARN-1000 Airborne Radio shall operate in the low frequency band and will provide accurate long range navigation for B-52, FB-111 and KC-135 aircraft.

2. The radio shall consist of the following components: receiver unit, processor unit, control and display equipment, antenna coupler unit, and equipment rack.

3. The receiver unit shall take signals from the antenna coupler unit and smooth. The resultant signal shall be sent to the processor unit.

3.1 The receiver unit shall conform to MIL-SPEC XXXX provisions for reliability and shall include the following components.

3.1.1 Component A consists of ....

3.1.2 Component B consists of ....

3.1.3 Component C consists of ....

3.1.3.1 Component C/1 consists of ....

3.1.3.2 Component C/2 consists of ....

3.2 The processor unit shall consist of .....

4. Total system mean-time-to-repair shall not exceed 150 hours.

EXHIBIT ONE

CAPSULIZED EXAMPLE OF A SPECIFICATION DOCUMENT PAGE

Study Context

A weapon system moves from vague concept to concrete reality in halting and non-uniform steps. Even knowledge of the broadest weapon system needs is often imperfect and subject to change over time, because of perceived threat modification, technological breakthroughs, and changing priorities for scarce resources. This leads to an imperfect and shifting base of requirements upon which still more tenuous alternatives and trade-offs are made. The level where many operational needs begin to coalesce around one weapon system which will satisfy all these needs is the highest rung in a requirements ladder (See Exhibit Two). The amalgamation of needs derived from specific Air Force documents, such as Required Operational Capability or Specific Operational Need papers, are coordinated through Department of Defense, Office of Management and Budget, Executive Review, and Congressional committee review for approval. If successful, they become a Program Management Directive, which is levied from Headquarters, Air Force upon Air Force Systems Command. Air Force Systems Command assigns the embryonic requirements package to an intermediate development group (in the case of aircraft and associated equipment, it is the Aeronautical Systems Division). This group assigns the requirement

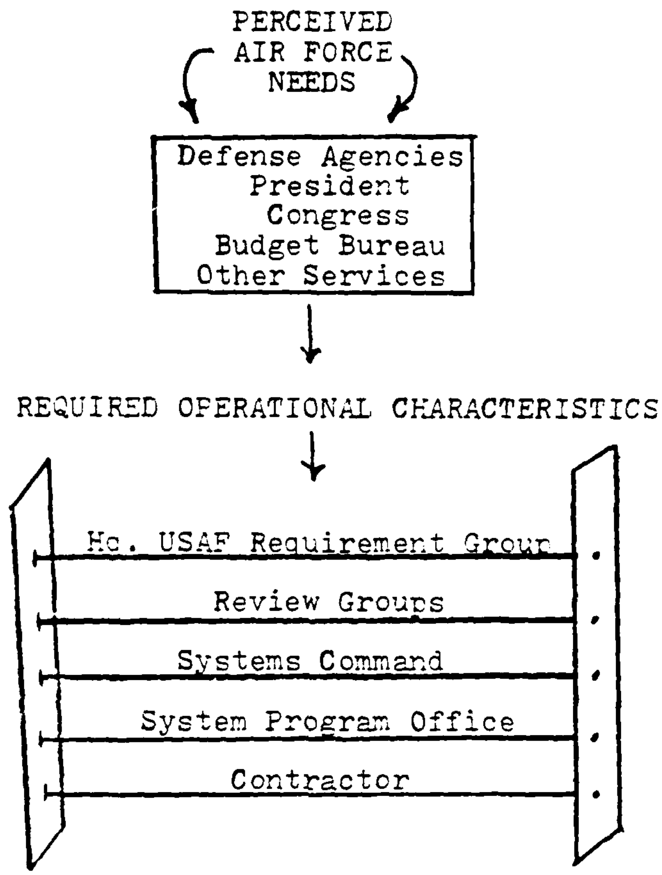

EXHIBIT TWO
THE REQUIREMENTS LADDER

package and direct developmental responsibility to a System Program Office which negotiates with an aerospace contractor for the actual engineering effort. The characteristic of uncertainty is present in virtually all development projects, regardless of its context. Peck and Shearer[1] view weapon system acquisition uncertainties as more intense and markedly different from those encountered in private business. The highest rung of weapon system requirement ladders experiences external uncertainties which include postulated scenarios of enemy intentions, estimated capabilities of competing weapons, and the risk that national priorities will divert necessary funds away regardless of program merit. Internal uncertainties enter on lower rungs. Since weapon systems usually push the technology frontier, the uncertainty is large. These internal uncertainties are primarily those associated with encountering those new technical difficulties and with the growing complexity of a large number of unknowns, which must interface. The process of solving these problems has become an iterative one:

> The principle activities in the major system acquisition process are iterative. As more knowledge of needs, alternative solutions, actual capabilities, resources and priorities is acquired, some steps in the overall major system cycle may be iterated, as

> necessary to permit decisions to be made in a total system context. It is difficult to graphically illustrate all of the possible iterations which might be involved.[2]

Uncontrolled iteration is the bane of an orderly weapon development process. Not surprisingly, this has pushed Air Force management to center their attention on control of the process. This process perspective, some knowledgeable critics say, has come at the expense of adequate attention to the objectives (requirements) which that process was supposed to secure:

> Management has the function to solve problems that stand in the way of objectives. It is easy to become so preoccupied with how we are managing our management systems that we forget what we are managing and why - - our objectives.[3]

<u>The Link to Public Administration</u>

A systems management perspective and the resultant preoccupation with process to the detriment of goals, is not unique to the Air Force. This phenomenon has been observed in the larger set of American public administration. One noted writer (Kaufman, 1956)[4] traces the growth of American public administration through three ages. The first age was dominated by American "Yankee Independence" which was gained, in part, as a reaction to harsh British rule. During this age of government, the individual rights of each per-

son were jealously guarded and the governmental institutions were established to be as representative of constituents as possible. Inherent in this system was the belief that popular goals could be achieved by wresting some consensus from diverse inputs. The very diversity of input allowed all important alternatives to be considered. The democratic process of logical debate, compromise, and majority rule was considered a sufficient mechanism for selecting one course from many.

As Kaufman explains, this noble experiment eventually developed a tragic flaw. The growing number of decisions required of government, coupled with their increasing complexity and difficulty, generated strong pressures to reduce the diverse inputs to a manageable sub-set. This license to limit inputs was not administered in a manner to either recognize obligations to diverse constituencies or to increase the probability of netting all important alternatives. Rather, it grew as an adjunct of power and the political process. Access to the governmental decision process was increasingly left to the bureaucratic specialists and their immediate circle of constituents. These specialists were increasingly appointed as a result of political

affiliation and favor, rather than special knowledge or sensitivities to popular needs. In short, the representative style of government eventually decayed into what has commonly become known as the "spoils system", present during the time of Andrew Jackson. The reaction to this spoils system was widespread and long-standing.

From the 1830's to the Pendleton Act of 1883, criticism grew but no vehicle of change emerged (Mosher, 1968)[5]. Even the Pendleton Act, inspired by the British civil service, was more important for the seeds of change it carried than for its revolutionary impact on the existing government. The new civil service system, wrought by the Pendleton Act, accepted the dual principles of standards for minimal job competence and political neutrality for its members. This age is described by Kaufman as the "neutral competency" age.

A hallmark of this politically neutral system was job protection or tenure for employees in virtually all cases except gross impropriety or widespread governmental reduction in job positions (not just people). Even these cases were handled by highly specific, standardized steps, and there was an easily accessable appeal channel for job holders thus threatened. Members of the growing American bureaucracy were thus

increasingly isolated from pressures not directly related to actions of gross impropriety. Further, the standard for judging one's job performance became efficiency - - the accomplishment of a given task with a minimum of resources and energy expended. As the standard of minimum performance became more codified for each job, the main question became how efficiently one met that standard. Both factors, the isolation inherent in political neutrality, and the growing emphasis on efficiency standards based on narrow job descriptions, caused an inward and rigid perspective on pre-set performance criteria. Responsiveness to change or questioning of job standards relative to program goals gradually became uncommon. In General Holzapple's modern day anology, focus on the management system has taken precidence over concern for the objective.

Kaufman sees the growing pressures on presidents such as Kennedy, Johnson, and Nixon to cut through bureaucratic red tape as indicative of the third age - - that of "executive leadership". While this age brought a new conflict to the members of the burgeoning American bureaucracy from above, it did little to change their narrow and rigid perspective. This third age has meant confrontation but not obsolescence of the modus operandi established in the second age.

Having witnessed the growth of American public administration in much the same perspective as Kaufman, several public administration scholars stepped back from the problem and defined it in more general terms. Lloyd Nigro describes a characteristic of public administrators by borrowing a term from Karl Manheim called "functional rationality":

> A series of actions organized in such a way that it leads to a previously defined goal. Every element in this series of actions receiving a functional position or role. Functional rationality is enhanced when means are coordinated most efficiently.[6]

In Nigro's terms, the neutral competency period and the subsequent executive leadership period had so constrained administrators' perspective inwardly and on process to the exclusion of goals that their actions could be essentially described as functionally rational. The ultimate harm was the de-emphasis on objective. Herbert Simon addresses more directly the process an administrator uses in decision making. He argues that any decision has in it inherent parts of fact and value:

> Factual propositions are statements about the observable world and the way in which it operates. In principle, factual propositions may be tested to determine whether they are <u>true</u> or <u>false</u> .... Decisions, are something more than factual propositions.... they select one future state of affairs

> in preference to another and direct behavior toward the chosen alternative. In short, they have an ethical as well as a factual content....Since decisions involve valuation of this kind, they too cannot be objectively described as correct or incorrect.[7]

This "value" (which is generally overlooked) is a measure of the association of the utility of any given decision to broader goals. Often, it is a testing of a decision against criteria defined by higher program goals. "Fact" is associated with the analysis of a situation. It is the latest analysis of "what is" in a dynamic process of change. Analysis and emphasis on the process of change is a good thing in that it leads one to seek logical relationships and to try and find patterns in a morass of events and activities. The quintessence of logical inquiry was considered to be functional rationalism. Using either Simon's or Nigro's perspective, we see how public administrators have evolved a systematic management approach preoccupied with logical sequences of activity and only loosely checked by comparison with broader program goals.

It has been argued that American public administration has evolved from a representative system sensitive to popular goals into a bureaucratic system preoccupied with management systems and efficiency standards. The inner workings of a public agency reflect

this general condition in specific ways. Emphasis on standards for performance in an agency as the test rather than political attributes of a job candidate, led to detailed job descriptions for each position. Since a person's job is minutely defined, performance is usually measured by how efficiently he does the prescribed job. No mention is made in the position description of license to ignore or modify tasks because they may no longer fit the program goal. Innovation is rarely rewarded if it comes at the clear expense of a written task, because rewarding even a good innovation thusly sets a precidence of condoning rule breaking. Not only does the internal standard of each job description foster this narrow perspective, but so does the relationship between job standards. As civil service organizations have developed, a hierarchy of job position descriptions has emerged. Each job description is formally related to those upper, lower, and lateral positions by lines of command and coordination. In a real sense, the role descriptions of each organization is thus functionally rationalized.

The Air Force as a Public Agency

The history of Air Force weapon system acquisition shows marked traits of political buffering and functional rationality. From its earliest days, the military has used civilians directly controlled by the civil service system for a major part of the standing force responsible for weapon acquisition. This is the same civil service system spawned by the Pendleton Act and just described as now containing highly structured job and organization functional descriptions. Positions not held by civilians have been held by military officers. This officer corps grew during the same time as the civil service system and shows some common characteristics. Although the concept of an elite officer corps is ancient, the constitutional requirements for civilian political appointees as leaders serves to blunt political inputs of such a tight-knit and stable organization. This protection of national decision making channels from military influence has had the reverse effect as well - - that of making the military hierarchy resistant to diverse political influences. Thus the military also has evolved an analogous system based on job descriptions and functional rationalism. While there are some major differences, such as military job

rotation based on individual career progression concerns and not job slot competition, the way civilians and military reach technical decisions are essentially the same.

Air Force Acquisition History

During the days of George Washington, a cannon was bought by specifying some minimal and very gross functional requirements (e.g., it must throw a sixteen pound ball two hundred yards) and reliance on the reputation of the builder. The weapon goals were specified in terms of the mission it was to serve. Inherent in this business transaction was the trust that both parties knew well enough what constituted a cannon. Further, accepted practices were sufficiently developed for producing that cannon so that no bad surprises (such as a barrel melting after ten shots) would develop. Weapons were simple; contracts were simple. In 1798, Eli Whitney sucessfully applied a relatively new concept of interchangeable parts on muskets and contracted with the government to manufacture them. Eli Whitney demonstrated that planned attention to detail and the use of engineering tolerances could produce a product which assembled on the first try. Weapon system design took its first serious step into design detail. No longer would requirements levied on contractors be as they

were in George Washington's time. Henceforth, considerations about product component design and engineering tolerances would be a commonly accepted facet of the contractual transaction.

Using this partial history, it is now possible to begin to weave the historic development of weapon system acquisition into the fabric of a public agency's functional rationalism. Requirements, now as then, are of two major types. First, there are required characteristics of the product itself. Highest of these are the requirements for the mission to be accomplished, followed by other functional statements necessary for the product to exhibit such traits as good maintainability and reliability. Next comes design details. These specify the composition of the product rather than its function. A second type of requirement is one specifying some type of contractual performance or compliance. This type centers on the contractor's process and not on his product. In essence, it grew as an amalgamation of "lessons learned" from prior developments and ultimately became formalized in regulations and manuals specifying various management schemes, techniques, and reporting systems.

Functional rationalism is said to have a definite impact on goals because of the preoccupation with

process. The Air Force weapon system acquisition analog to the general term "goal" is the more specific technical requirement - - the first type of requirement in the above description. The analog to the general term "process" lies in the government management and reporting systems. Those invoked on contracts are the second type of requirement.

Resuming with history, little change occurred in the military procured weapon systems during the years 1800 through 1917. The development process was generally left to the private contractors, or done completely by the military in various arsenals. Only sporadic interest was shown by various individuals of the Army Quartermaster Corps or the Signal Corps. The function of the government agents was basically one of procurement, and that of contractors was supplying a product they had already developed and made production ready.

In the fall of 1917, a Signal Corps Experimental Laboratory was established at McCook Field (now Wright-Patterson Air Force Base) near Dayton, Ohio. It was intended to form the nucleus of military research and development of experimental systems, which included airplanes. It grew and diversified during the next two decades. Whether actually conducted by the Army

or only monitered by them, research into the development of weapon systems was no longer the exclusive domain of private contractors. Even at this early time, the use of civil servants had become popular in order to maintain a stable pool of experts in functional areas. Functional organizations became an accepted principle during this time. For example, the engine experts at McCook Field were in one shop and supported development of several aircraft engine types from that home office. The traditional way of building an aircraft during that time was to use several diverse contractors, each supervised by a functional shop, and to somehow arrange a cooperative plan for all products (such as engines, instruments, and landing gear) to be sequentially delivered to the developing air-frame for assembly.

The functional shops found themselves supervising an ever more complicated situation as time went along. Referring to an earlier time, if one were building a musket using Eli Whitney's interchangeable parts, he might get the barrel from one contractor, the stock from another, and the trigger mechanism from still another. Interface between these parts could readily be controlled by reference to design detail drawings and special emphasis on engineering tolerances. It is im-

portant to note that such interfaces, even then, might be between different contractors as well as between parts. As long as accepted practices were dominant in the industry, and the interfaces low in number and complexity, assembly was accomplished with minimal problem. As airplanes became more complex, it became evident that the interface problem was no longer one of basically scheduling and assembling all procured parts. This growing problem, pushed along by power struggles among the functional shops, led officials at McCook Field to look for a better organization structure. In 1939, the first project shop was established.[8] The project shop took functional experts and assigned them to specific development programs under the operational control of a single leader. Although the expert was often administratively retained in his functional home office, he was operationally controlled by the project leader. Equally as important, resolution of conflicts between functions, which often occurs at the interfaces, now had a formal home with the project leader, instead of the previous situation in which relative power of the functional offices prevailed.

The Army now had two principle weapon acquisition functions at McCook Field. First, they were involved in <u>development</u> of airplanes and their compon-

ents. Just as importantly, they supervised the assembly of the developed aircraft in production. No single government office controlled both efforts. Dual development and production offices for each program was the rule and it worked well for many years. In the mid-forties, the B-29 Bomber was developed. The system complexity had reached such a point by this time and design and detail was so great, that no clear break point between development and production was evident. In a real sense, the integration problems of the various complex aircraft systems were so numerous, diverse, and interrelated, that interfaces normally worked during the production phase were being anticipated earlier in the design phase. Modern weapon development had come of age. Component design was now accomplished with an eye towards future interfaces. Making this now complicated development/production process work required integration of the dual program offices into one - - the first integrated System Program Office.[9]

The period between World War Two and the early 1960's saw a constant battle between two agencies and between two concepts. The agencies were the budding Air Research and Development Command, which was established by the Ridenour Committee of the Air Force Scientific

Advisory Board, and the older Air Material Command, which had previously supervised the early integrated program offices. The old belief in separate programs for development and production had already died. The obvious question revolved around which side of the interface should control the whole process - - development or production. The process moved from the dual program office concept originally used, to a "team captaincy" concept of Air Force Regulation 20-10 in 1954. It went through the "Gillette procedures" involving direct reporting to the Air Staff in 1955, to, finally, the Weapon System Management Study Group of 1959 which relegated Air Material Command to a secondary role. The question was thus answered and the balance had shifted to the development side and to the Air Research and Development Command.[10]

The two concepts at odds were the polar extremes to a question concerning who controlled the technical experts. With the growing complexity of weapon systems, private contractors found themselves hiring an ever increasing number of specialized experts. Unlike the military, these contractors could not simply assign their excess talent to basic research when not needed on a contract, they either found another contract or fired the excess. This often meant firing excellent talent

simply because no current contract needed that particular talent at that time. Contractors diligently searched for a way to maintain a stable labor pool of experts and soon came to covet the basic research and supplementary technical support on various contracts given by the functional shops at McCook Field. The functional shops at McCook Field, however, were deeply entrenched in the bureaucracy by the late 1940's. In the face of increasingly complex tasks, these shops generated pressure for larger increases in people and the ability to offer inducements sufficient to hire people away from industry in critical areas. Neither side scored a clear victory in this battle but it led to limited use of two new arrangements still used today. The first idea was to try a shift of the daily engineering burden of controlling a development and production from the government program to one single integration or "prime" contractor. Previously, the Air Force (which was officially constituted from the Army Air Corps in 1947) had matured from dual control to one central point of control for its development programs but it still did the engineering integration work itself. Now a contractor was hired who was to have total system performance responsibility for the component building and integration of the weapon system. The government program office still existed and

exercised final authority, but its role shifted towards management by exception.

The second approach occurred in response to the perceived missile gap of the early 1950's and our desperation to build an intercontinental ballistic missile in the shortest time possible. The Strategic Missiles Evaluation Committee of 1954 recommended a technical support engineering contractor be hired to advise the government on development of a missile placed on contract with a prime contractor. Their rationale for modifying the new prime contractor arrangement was set forth:

> After considerable discussion and negotiation, the committee rejected the use of a single prime contractor for the program on the grounds that no single industrial organization possessed the necessary range of skills and over-all capability required to perform the task.[11]

This type of technical consulting company was considered to be more flexible than a prime contractor because its focus was on solving short-run technical problems and not on the over-all development of a particular weapon system. Thus, such a company could bid for small, but highly technical consulting roles on many programs and therefore not suffer when the development cycle of any particular program had run its course. As one can see, this is the private contractor equivalent of the govern-

ment functional shops. Proponents of this type of company argued that civil service tenure guarantees and low relative governmental salaries were already turning functional shops into mediocre talent pools filled with people who learned their functional speciality years before and felt no pressure to stay current. The private consulting company, on the other hand, would be more flexible because it could immediately recruit in specific areas, pay the premium salaries necessary to hire scarce talent, and motivate employees to stay current through its ability to fire them simply and quickly for poor performance. The first contractor of this type was Ramo-Wooldridge Corporation.

Use of a prime contractor had reduced direct government engineering to technical management by exception. Further, it used government funds to maintain the true technical expertise in a program in the hands of their contractual adversaries. This was not considered altogether satisfactory and the subsequent rise of technical consultant companies was hoped to be an effective balance. Over time, criticism of these consultants also grew due, in part, to the conviction that the supposedly captive technical advisors had allowed their professional considerations to override their commitments to serve government goals. Where a program

might be interested in an acceptable engineering change which was inexpensive, the technical consultant might press for a more technically elegant alternative despite its cost. A Ph.D. in nuclear engineering does not want to measure radioactivity on a watch dial. This parochialism, coupled with their virtually unassailable technical base, was allegedly used to overcome government control of a program. Using Herbert Simon's terms, their overpowering control of the facts was their license to judge values. Modern Air Force weapon acquisition still uses a mixture of all three approaches.

John F. Kennedy's election in 1960 brought Robert S. McNamara to the job of Secretary of Defense. During the subsequent years, there was a dramatic increase in the scope of the Department of Defense Research and Evaluation Office's involvement in the military management process. This period was marked with increasingly centralized control and the institution of rigorous management systems to control the acquisition process. The introduction of McNamara brought a quick restructuring of Air Force acquisition. Basic research, that not pointed at a particular product, was assigned to a newly created Office of Aerospace Research.
Air Force development was assigned to the Air Force

Systems Command and the Air Material Command was re-chartered as the Air Force Logistics Command. An outgrowth of the 1959 Weapon System Management Group findings was the assignment of all responsibilities for acquisition (control of both development and production contracts) to the Air Force Systems Command. This was fleshed out in a new weapon system acquisition concept which was documented in a "375" series of regulations, manuals, and pamphlets. The 375 series was extensive in its coverage of the processes a System Program Office must go through in a development, and it detailed a growing list of collateral systems for configuation control, program control, and management reporting.

Further elaboration and modification of the management system occurred in 1971 with Department of Defense Directive 5000.1. A principle purpose of this directive was to correct the high degree of centralization in decision making started in the McNamara era. This directive specified de-centralization and outlined how that would work. It added information on management discipline, and developed its own regulations outlining program managers' functions during the various phases of a program life cycle.[12] The Air Force implemented 5000.1 in an "800 series" of regulations, manuals,

and pamphlets supplanting the earlier 375 series. Further codification of the weapon acquisition process into life cycle steps, the specific delegation of responsibilities and authority, and various management systems are all included in the 800 series. As the process has matured, the sequential action chain has become more and more functionally rationalized both in terms of organizational roles and in systematic steps required in a given program development. Contests of power between commands have been somewhat smoothed, authority of command levels clarified, and transition between program life cycle phases delineated. Further, as the process has become increasingly defined, systematic approaches to developmental problems have risen. Cost, being a major problem in development programs extended over time, has received its share of attention. The concept of "life-cycle cost" (which requires consideration of maintenance, spare part and other costs as well as production cost) has appeared. "Design-to-Cost" emphasis on designing towards some target production cost has become popular. In each area, the problem has been analyzed and integrated into the already established development system.

A Conclusion on Requirements

The focus on product technical requirements has not received the systematic attention as has that on process. Strayer and Lockwood say about this problem:

> The existing process turns on the main valve (the requirement itself) but it does not yet address, in sufficient detail, what should be included in the content pipeline.[13]

It is the thesis of this dissertation that a broad and flexible term must be defined to link high order conceptual program goals to specific design detail. Under this umbrella term a taxonomy of terms is necessary and some broad ground rules must be established controlling the build-up of content in each category. This term will allow emphasis of the step by step relationship of objectives as they are defined in increasing detail. It will serve as a foil with which process oriented management systems are parried to the ultimate end of achieving a more balanced style of weapon system acquisition. The term used will be the requirement.

CHAPTER ONE ENDNOTES

1. See Peck and Shearer's The Weapons Acquisition Process: An Economic Analysis (Bibilography Number 39).

2. Reference Office of Federal Procurement Policy's report "Major Acquisitions - A Discussion of the Application of OMB Circular No. A - 109", page 5 (Bibliography number 51).

3. Excerpted from General Holzapple's address "Air Force System Command Report 375 - 1 Number 53", page 1 (Bibliography number 18).

4. See Herbert Kaufman's "Emerging Conflicts in the Doctrines of Public Administration" (Bibliography number 25).

5. See Frederick Mosher's Democracy and the Public Service (Bibliography number 35).

6. Reference Lloyd Nigro's article "Administrative Behavior and Self-Rationalized Man" on page 29 of Political Science Journal, Volume 5 (Bibliography number 38).

7. See Herbert Simon's book Administrative Behavior, page 46 (Bibliography number 47).

8. See Putnam's "The Evolution of Air Force System Acquisition Management", page 2 (Bibliography number 44).

9. Ibid, page 3.

10. Ibid, page 5.

11. Ibid, page 8.

12. Reference Charles Hoskins' "Analysis of Engineering Transfer of Acquisition Systems", page 5 (Bibliography number 19).

13. See Daniel Strayer and Lyle Lockwood;s article "What Are We Buying Here?, page 2 (Bibliography number 52).

CHAPTER TWO - - ACADEMIC BACKGROUND

Academia and Technical Management

The purposes of academic study are generally aligned with the growth of knowledge while those of practical management are with controlling alternate futures based on past experiences. When one first studies an emerging practical problem area, the interests of academic knowledge often coincide with concerns of practical management. The pioneering work of authors like Gulick and Urwick served for many years as both an academic base for study and a practical guide for operation. In weapon system acquisition, the pioneering work of Peck and Shearer has had a similar effect in establishing uncertainty as a key area of interest both of academic and practical observers. There is no argument that the academic concepts of uncertainty and the practical consequences seen by managers need further study. A more global question concerning weapon system acquisition epistemology is raised.

A discussion of management epistemology was raised by Kozmetsky and Cunningham in a 1974 paper. Their paper was intended to "provide a framework to link in a unique body of science the knowledge acquired through both the academic management and the practical

management."[1] Key to this dissertation was their recognition that a "theory of the nature and grounds of knowledge with reference to its limits and validity"[2] (their definition of epistemology) depended on both academic and practical conceptual constructs. They recognized that each of these types of construct were already defined in different functional contexts and that many already had their own sub-epistemologies. Thus academic disciplines of business administration, education, engineering, law, and public affairs must relate in practical environments of government, business, and unions, to name a few. The diverse conceptual constructs and sub-epistemologies requires assimilation of pertinent parts of each into partial management epistemologies. In this context, the practical and academic concerns on uncertainty form only a small part of an assimilated epistemology, just as if one used only parts of the academic functional constructs with a limited range of practical experiences. While this dissertation does not chart the boundaries of a weapon system acquisition epistemology, it adds another important element which is the study of technical requirements.

Early Studies - - Uncertainty and Complexity

Peck and Shearer set the pattern for subsequent writers in their oblique analysis of requirements in their book, The Weapons Acquisition Process - - An Economic Analysis.[3] Notably, the term "requirement" does not appear in the index. The end points of the weapon acquisition process probably seemed too clear for discussion. One starts with a single need statement; one is satisfied only when a product is delivered. Their attention, therefore, centers on the process of taking the product from one extreme to the other. The prevailing characteristic of the process is that a few broad requirements grow to many specific ones. This growth of requirements takes a product from uncertainty to certainty. The process of taking requirements from one extreme to another involves a series of decisions over contemplated actions:

> ....we define uncertainty as the relative unpredictability of the outcome of a contemplated action.[4]

Peck and Shearer maintain that uncertainty can exist in two basic forms. External uncertainty is the uncertainty of need or strength of support coming from outside the program. It reflects updated assessments of the threat, desirability relative to technical break-

throughs, and relative priorities with other programs for allocation of funds. Internal uncertainty is that which is caused by the facing of technical difficulties and complexities within the program. It is the iterations and blind alleys one sees when trying to fit numerous complicated requirements into one puzzle. Peck and Shearer state that this is a major contributor to technical difficulties and have labeled this type of internal uncertainty as complexity:

> ....yet if the major effort is engineering, it has become increasingly complex engineering. Indeed the most striking feature of current weapon system programs appears not so much to be the magnitude of the state of the art advances attempted as their tremendous complexity.[5]

Some requirements get specified simply as a consequence of the higher requirements they meet. For instance, significant portions of an airframe can be designed using standard design concepts, materials and fasteners if the environmental performance requirement has been previously met. Other requirements are not so simple. These are what Peck and Shearer would call "technical problems". In continuing the above quote, they say:

> This complexity creates uncertainty in at least three different ways: in total number of technical problems involved, in the inter-relationship between

> technical problems, and in the reliability requirements generated by the sheer number of individual components.[6]

Requirements have thus been seen for their characteristics of uncertainty and complexity, and have been singled out for particular attention when they - - individually or in groups - - cause technical problems. Peck and Shearer's perspective centering on contemplated action included necessary elements of the definition of a requirement because only a culminated contemplated action can be forceful in a contract and Peck and Shearer's analysis uses outcomes of contracts as evidence supporting their positions. Requirements are the expression of a culminated contemplated action.

Later Years - - An Oblique Interest Continued

The tendency of looking at requirements only when they cause technical problems or exhibit the results of uncertainty and complexity, has been carried forward by other researchers. In a more positive perspective, these authors have tried to anticipate areas where problems would likely occur and focus on a subset of those most crucial to program success. These crucial and problem prone areas are listed as "technical performance parameters" and are tracked from early in a development. One researcher couples this

with a "subjective probability approach" (Timson, 1968).[7] This approach hinges on the premise that although subjectively done, measures of uncertainty can be taken over time. An argument is advanced that "progress is characterized as a reduction in uncertainty", thus progress can be measured on identified technical problems. A major assumption in advocating such an approach is that a project can be expressed in terms of its critical parameters and that a combination of routine attention on straightforward requirements and intensive attention on critical requirements will lead to a successful development. This process seemingly covers the universe of requirements, but Peck and Shearer's concerns over complexity, and especially "the interrelationship between technical problems" argue that the problem is, perhaps, more than the sum of its indiviual parts. While one can argue that a formalized process of gradiated attention on selected problems is one useful management tool, he cannot argue that this process is a definative answer to the nature of requirements growth.

Control systems have always been popular as a research topic due, in part, to the fact that they result in immediately useful conclusions. Meiners reviewed Peck and Shearer's work with the intent of describing a

system to control changes that occur in the requirements process from concept to implementation.[8] Inherent in his approach is the assumption that program changes are anomolies in the normal flow of requirements evolution. Peck and Shearer attributed such program changes to program uncertainty, contractor optimism in bidding, and a lack of a sense of urgency. This led to schedule slips, funding slips, and ultimately requirements changes. The conclusions of Peck and Shearer were the result of a large amount of data accumulated from previous Harvard Business School studies, and in particular, an economic analysis of nineteen programs by the authors and their research team. Meiners uses questionnaires from program leaders and contracting officers of twenty-five programs. While his sample is more extensive, the depth of analysis is not as deep. He concludes that the four main causes of program change, in order of importance, are:

1). changes in operational requirements imposed on the system,

2). incomplete early plans and technical definition,

3). changes in program funding, and

4). changes in the program to accommodate new state of the art development.

Reviewing Peck and Shearer's previous definition of an

internal and external condition of uncertainty, one sees fundamental support by Meiners over its role in affecting programs. Classically, Meiners' causes (1), (3), and (4) are external uncertainties while (2) is just as classic an example of internal uncertainty. Recasting Meiners' list of causes into terms involving requirements, one sees the major causes of program changes to be either an externally forced change to what a program had previously considered a firm requirement, or the lack of definition by a program as to what actually constituted its requirements in the program. A particular salient point concerning incomplete early technical definition, is that such internally derived requirements are usually the first type to require statement in different terms and documents than the imposed operational requirements. In most cases, operational requirements are specified by agencies external to the program and are an expression of high order conceptual needs. Initial technical definition is more pointed at specific functional characteristics of hardware and even includes some technical detail. Considering Meiners' conclusion in this light, one is led to question the problem as being more than the sum of the parts. In this case, the different languages used between imposed operational requirements and derived functional and detail requirements can actually exacerbate each of the individual relationships.

Several studies have dealt with the subject of uncertainty but did not deal with the effects of requirement growth. As was previously covered, requirements growth is ideally envisioned as an orderly process which is disrupted by forces including those labeled as external and internal uncertainty. The bulk of the uncertainty studies focus on one of the consequences of disorderly growth, namely unanticipated cost growth.

Sponsler, Gignoux, and Rubin[9] attempted to find some parametric estimators of program costs for fighter aircraft. Using historical data from twenty-three completed fighter programs, they generated a regression equation using aircraft empty weight, wing thickness ratio, and avionic power as independent variables. Despite mixed results on two still-developing aircraft, the equation appears to do as well as any previous estimator. A review of their parameters reveals an interesting relationship. Empty weight is a direct indicator of size. It has long been used as a measure of both uncertainty and complexity. Avionic power represents a modern day addition. Where large scale electronic integration has prevailed, both weight and volume have often decreased while functional complexity has risen sharply. A small ratio of wing thickness to wing chord is an indicator of "increased technical

sophistication".[10] All three terms are thus highly linked to technical uncertainty and complexity.

One can conclude from the writings, to date, that uncertainty and complexity cause problems in a program's development, and that this is likely seen in its requirement growth pattern. Further, the consequences of such disorderly growth is shown in areas of performance, schedule, and cost. A disquieting note to this conclusion is sounded by Henry.[11] His look at initial conditions of weapon systems as predictors of cost, used the early development budget to predict subsequent program cost. He intended this parameter to serve as a surrogate for technical uncertainty, believing that programs embarking on the most uncertain development paths would have the highest initial development budgets. The study results showed no significant relationship. Henry did, however, note:

> It may be entirely possible that the definition of development investment is inadequate to the task of measuring technical uncertainty. Despite the fact that a majority of programs (40 of 48) met or surpassed the performance goals set for them, and that the "science" of predicting what is feasible may be more efficient than the "art" of estimating cost or schedule outcomes, one should be reluctant to surmise that developmental effort has less effect on project success than other program variables.[12]

Perhaps Henry's intuition that development cost reflects technical uncertainty can be sustained with the addition of a single word. It is highly possible that perceived technical uncertainty is met with higher initial developmental budgets and that the perceptions were wrong. The study is not persuasive enough to refute the wealth of other findings which support the relationship of uncertainty and developmental problems.

A more direct study of uncertainty and cost was the entropy model developed by Martin.[13] The basic premise of this model was that a thermodynamic law actually modeled information growth:

> The expression has been defined as a measure of disorder in a closed system. This definition has to be redefined. Entropy is a measure of the amount of information in a system; in particular, it encompasses the number of choices available to a decision maker. Entropy relates to the degree of randomness of the information, not to informational efficacy. As entropy increases, information increases, uncertainty increases, freedom of choice increases, but the informational efficacy decreases as related to the specific source. In accordance with the second law of thermodynamics, the tendency is for the entropy in a system to always increase.[14]

Adding to this basic definition, Martin concludes that uncertainty, being directly linked to entropy:

> increases in direct proportion to the number of unknowns involved and the distance in the future of the contemplated events. Thus uncertainty is a direct function of time.[15]

This leads Martin to measure relative uncertainties among programs by charting the size of their relative decision trees: the more choices for alternatives, the more entropy and hence the more uncertainty. The Martin model is intended to explore the conceptual relationships of cost and uncertainty and it concludes:

> The conclusion emerged that cost and risk analysis should be combined into cost uncertainty analysis, and each aggregate cost estimate should include a section which evaluates cost uncertainties.[16]

The Martin model was subsequently tested using a Delphi method to reconstruct the decision trees of the Short Range Attack Missile.[17] The conclusion was that some statistical support was found for the theory. Since however, this single sample asked program people to re-cast an already completed program, there is some concern that their recollections might well be a form of self-fulfilling prophesy - - high cost areas, in retrospect, would be seen as results of uncertainty.

An attempt was made to expand the Glover iteration of the Martin model to the F-5E aircraft.[18]

This attempt provided a cost variance of over 900 percentum from actual results and caused the authors to question the Delphi method for testing entropy.
Evaluation of the Martin model leads a person to con-

clude that it is not an especially good vehicle for evaluating requirement growth per se. Uncertainty is a phenomenon that manifests itself differently on cost, schedule, and performance. The contention that requirements grow from uncertainty to certainty is so logical as to be a truism. Martin postulates growing uncertainty. The conciliation lies in the different perspectives. While there is an increasing number of alternatives in a development, and while effort on each means increased engineering time and expense, these alternatives are worked to conclusion. So while cost increases, requirements are becoming firmer. As cost uncertainty increases, requirement uncertainty decreases. Use of the Martin model to investigate requirement growth, therefore would require first a better validation of the model (in light of its mixed results) and then a validation of the inverse relationship between cost and requirement growth uncertainty. While this can be a valuable exercise for future researchers, the current research base makes it a highly tenuous and indirect alternative.

Learning Analogy Used in Understanding Requirements

If analysis of the direct academic work on weapon system acquisition has proven an unsatisfactory framework for understanding requirements, one must ask about

the use of potential analogies from other academic fields. Martin used the field of thermodynamics effectively to model cost uncertainty. A potentially valid field for evaluating requirement growth is the area of learning theory. Indeed, the ultimate definition of a program, from initial concept to final product, is inherently a result of learning. The mainstream of learning theory contains a concept called "attainment":

> Attainment refers to the process of finding predictive defining attributes that distinguish exemplars from non-exemplars of the class one seeks to discriminate.[19]

A principle objective of learning theory is to put order into observation. A fundamental tool is the concept. One observes several instances of an interesting phenomenon and sees that there is a uniquely common group of characteristics which differentiate that group from other close ones. This is the attainment process. The sub-set as defined by its common group of characteristics is labeled with a term - - that term being the conceptual equivalent for listing all the characteristics. A term or concept is thus attained and retained by one's recognizing a mutually exclusive arrangement of characteristics which alone define that concept. <u>How</u>

one attains and retains the concept in memory is open to some conjecture between two different schools of thought. The conflict first became heated in the late eighteen hundreds between the Wundtian Elemental and Gestalt factions. The Elemental school forwarded the proposition that concepts were learned independently of associations with other concepts. Thus through rote memory, one learned and retained the defining characteristics of a concept. The Gestalt school proposed that learning and memory depended on the relationship of the concept with concepts already retained. One school proposes concepts with clear conceptual boundaries and emphasizes detailed study of those boundaries to the exclusion of all else. The second school proposes that concept boundaries are not so clear. Concepts are, in fact, clustered in many patterns with other concepts, much as in the logic associated with venn diagrams. Thus, understanding and remembering a concept must occur in association with the other related concepts. While many scholars freely borrow from both schools, no single eclectic school has emerged:

> At the centre of all of these is the basic Gestalt issue, by no means resolved by the middle of the 20th century, of empty hookups versus meaningful organization.[20]

In weapon acquisition, diverse operational needs coalesce around one integrated but gross concept of a weapon system. It is important to recognize that a weapon system is conceived specifically as an answer to a combination of important needs and not as a moderni-zing innovation sans specific mission requirements. No aircraft is built simply because it is time for a new model as is done with cars in Detroit. Once these needs are set, a research and development process occurs to obtain definition of requirements which will satisfy higher needs. Requirements beget requirements. Al-though higher requirements, they do limit the alterna-tive range. A requirement is a formally expressed con-cept. What the process therefore contains is a hier-archy of concepts, each constraining the lower ones. The process of finding lower alternatives is generally done with some form of satisficing.[21] As Martin showed, alternatives increase greatly as a program progresses while generally the designers do not, thus satisficing is more or less forced on a program.

Requirement growth is not only a process of sorting alternatives in a hierarchial framework. Work of previous authors cited (Peck and Shearer, Meiners, Sponsler, to name a few) technical complexity as a major

factor in program development. Peck and Shearer's list of three types of uncertainty caused by complexity established interrelation between technical problems as one particular type. Complexity, in part, is seen to be a development problem and is seen as one of association of requirements causing technical problems. The problems associated with combining technical requirements is thus not simply a summation of the individual problems. They more accurately fit the description of a Gestalt:

> When spatial, visual, auditory, or intellectual processes are such as to display properties other than could be derived from the parts of summation, they may be regarded as unities illustrating what we mean by Gestalten.[22]

This perspective leads directly to the premise that understanding of the weapon acquisition process will require not only a clear definition of requirement types, but also an understanding of the relationships between requirement types.[23]

CHAPTER TWO ENDNOTES

1. Reference Kozmetsky and Cunningham's unpublished paper "The Importance of Management Epistemology and Reasons for Including it in the Integrative Course", page 28 (Bibliography number 23).

2. Ibid, page 2.

3. Reference Peck and Shearer's book, The Weapon Acquisition Process: An Economic Analysis (Bibliography number 39).

4. Ibid, page 17.

5. Ibid, page 42.

6. Ibid, page 42.

7. Reference Timson's article "Decision Making Under Aggregate Uncertainty: The Engineering Decisions in a System Development Project" (Bibliography number 54).

8. Reference Arthur Meiners' thesis "Control of Major Changes to and Resultant Cost Growth in Weapon System Acquisition Contracts" (Bibliography number 34).

9. See Sponsler, Gignoux and Rubin's thesis "Parametric Cost Estimation of Fighter Aircraft" (Bibliography number 49).

10. Ibid, page 7.

11. See Douglas Henry's thesis "A Statistical Analysis of the Effectiveness of Program Initial Conditions as Predictors of Weapon System Acquisition Program Success" (Bibliography number 16).

12. Ibid, page 56.

13. See Dean Martin's dissertation "A Conceptual Cost Model for Uncertainty Parameters Affecting Negotiated, Sole-Source, Developmental Contracts" (Bibliography number 31).

14. Ibid, page 121.

15. Ibid, page 168.

16. Ibid, page 123.

17. See William Glover and John Lenz's thesis "A Cost Growth Model for Weapon System Development Programs" (Bibliography number 14.)

18. Reference Anthony Babriaz and Peter Giedras' thesis "A Model to Predict Final Cost Growth in a Weapon System Development Program" (Bibliography number 1.)

19. See Bruner, Goodnow and Austin's book A Study of Thinking, page 22 (Bibliography number 4).

20. This is taken from the Encyclopaedia Britannica, the 1967 edition, Volume 10, page 371.

21. See March and Simon's book Organizations (Bibliography number 30).

22. Reference Willis Ellis' book A Source Book of Gestalt Psychology (Bibliography number 11).

23. For a discussion of the basic research sources and methods used in this dissertation, refer to Appendix One.

CHAPTER THREE - - THE CONCEPTUAL MODEL

System Acquisition

Weapon acquisition history has been a process of evolution from a fragmented military buying system involving several organizations into a single development and buying group unified under one command. The term "System Program Office" was given this type of group and it had the following characteristics:

1). the responsibility for development and potential acquisition of an entire system which includes ground test equipment, training and technical manuals, simulators and all other equipment and plans needed to acquire and integrate the basic into the existing force structure, and

2). the major autonomy in describing and justifying its actions and on-going requirements for manpower and funding.

A similar organization also arose, known as the "project office". Generally, its main distinction was that this group worked with less than whole system (e.g., a radio for use in several aircraft). Most often, this project office was directly controlled by an intermediary agency which took the lead in management actions for all external dealings - - especially for requesting and justifying funds needed and already spent. Currently, there are two basic types of controlling agencies, both variants of the original System Program

Office. One type uses a System Program Office almost exclusively for the external interfaces, and emphasizes technical responsibility in the subordinate project office. The second type, often called the "basket" System Program Office, evolved as a natural consequence of the functional shop organization. In this type, large areas of relatively common developments are grouped under one composite System Program Office, which once again handles the external interfaces. Whether one selects a project office or a System Program Office to model depends on what requirement types are to be investigated.

A Requirements Taxonomy

Strayer and Lockwood proposed a taxonomy for weapon system acquisition. Included below are the elements of that taxonomy with their description of each:

> Mission Requirements ultimately quantify the need for acquisition. Included in this category are the functional definitions, e.g., transportation of troops, cargo; destruction of targets; transmission of messages, etc.. Also included in this category are surrogates for functions commonly called performance parameters. Examples of these are: speed, range, altitude, capacity, effectiveness, accuracy, etc.. In total, the mission requirements define the purpose of the system. They spell out what the system is expected to accomplish. They deal with accomplishment in the mission performance mode, that is, in a brief, usually mission-defined time span. Thus they are almost measured instantaneously during the test and operating modes. Measurement, and therefore evaluation, can be both rapid and reasonably accurate.

Operating Characteristic Requirements quantify many of the efficiency indicators of the system. They include a much longer time consideration because they combine the functional components of life cycle cost - - reliability, maintainability, quantity and quality operators, expected useful life, logistics support, and component interchangeability standards. These requirements impact on the system design. However, they are not usually measurable at the same time that mission requirements are measured. The success of satisfying such life cycle considerations is measurable only over time, frequently a rather long time continuum.

Design Standards and Specifications deal with the transformation of mission requirements and operating characteristics into hardware. They describe specific knowledge of measurement inputs into the design process. Included in this category is the stated order of preference for specifications and standards - - components, materials and processes. The order of preference results from the belief that specifications and standards are the corporate body of knowledge. They are codified lessons learned. As such, they become inflexible guidelines or directives to the contractor. We impose them as design constraints in order to avoid new development costs, assure standardization, strive for competative procurement of homogeneous products, and avoid costs of nonstandard components. All of these are worthy and desirable goals.

Management Systems Specifications and Standards either specify the nature of an organizational behavior pattern or require the disclosure of specific managerial information. This category is examplified by such things as program management requirements, system engineering management plans, reliability program plans, configuration management plans, cost schedule control systems, and the like. The purpose of each category in this requirement is common: to elicit a desired level of contractor behavioral or managerial response.

Legal Obligations include both mandatory and bilateral requirements that are placed on the contractor and the government program office by basic contract law, federal law, or agency regulations.

> Legal requirements are designed to accomplish various national and program management objectives. These have various political, economic, technical or social dimensions. Examples are many and include the Walsh-Healey Act, OSHA, environmental protection regulations, equal employment opportunity regulations, the cost accounting standards, and many more. In addition to the legal obligations mandated by law, bilateral requirements are frequently agreed on by the contracting parties and include type of contract, method of payment, restitution, warranties, correction of deficiencies, government-furnished property or services, forward pricing agreements, adjustment for abnormal price escalation, and the like.
>
> Programming Requirements are allocations of total program costs and quantities into annual or other periodic partitions. These are usually described in terms of funding ceilings, time-phased budgets, and delivery schedules. In an unconstrained mode, these requirements are a statement of when the mission need must be satisfied. These requirements are initially defined by the using command and modified by planning staffs and development agencies. Further modification or adjustment of programming requirements are made throughout the federal budgetary process. The resolution of programming requirements and mission requirements has been the focus of annual debate at the national level.[1]

Two additions to the Strayer/Lockwood taxonomy are made for the conceptual model. Included in the definition of the Operating Characteristic Requirement is:

> Operating Characteristic Requirements also include the functional statements that relate components or systems to some specific task necessary for fulfilling the mission requirement. These requirements are not so broad as to be mission requirements, themselves, but neither are they as inflexible guidelines as defined by design standards and specifications. An example of this type of requirement is

> the statement that a radio must have a back-up transmitting capability in case of specified types of failure.

A further addition to the taxonomy is the addition of a new type:

> Interface Requirements are a special class of operating characteristic requirement which, by its nature, deserves special attention. These express a preconceived relationship between different mission requirements, operating characteristic requirements or some combination. Interface requirements characteristically work with only one side of an interface and is intended to constrain design on the other side to a selected set of characteristics. They often work with specified functions and characteristics on an evolving design which is required to match an existing design on the other side of an interface. As design proceeds to its lowest level of detail, it is normal to see an increasing number of requirements which relate one detail requirement to another. This type of statement is a logical consequence of evolving both sides of an interface together. The lack of preconception on one side rules this out as an interface requirement and makes it simply a design standard and specification requirement.

The conceptual model thus uses an expanded Strayer/Lockwood taxonomy. For ease of description, the element titles have been shortened:

Mission Requirements
Operational Characteristics
Interface Requirements
Design Requirements
Management Systems
Legal Obligations
Programming Requirements

The focus is further narrowed, as one might have surmised from the introductory chapters, to technical requirements. Indeed, it is the premise of the historical evaluation that Management Systems, Legal Obligations, and Programming Requirements have received a disproportionate amount of attention while the requirements which directly define a system have been neglected. The first four requirement types in the taxonomy are technical requirements and are the elements of study. Confining requirement types to technical ones leads to selection of project shops instead of System Program Offices which deal with the entire taxonomy of requirements.

The Life Cycle Development

When considering the relationships of requirement types over time, one sees a close parallel in the interest on the life cycle of a program. The product life cycle of a weapon system is not described in terms of requirements, yet it also addresses development of a product from concept to final product. Understanding and use of the notion of life cycle therefore provides a valuable touchstone with which to relate requirement growth.

The original cycle from a military vantage was simply inspection and use. The item was inspected or tested to see if it met a set of (often unwritten) needs.

If it did, it was purchased and put into use. Entry of the government into the weapon development business added that phase before an item was tested and used. As weapon systems evolved, requirements became more complex, and government involvement in early design phases became more intense. A phase for defining the needs of the program was added to the beginning of the program. Seen from another perspective, the problem of weapon system development was rapidly being functionally rationalized. The currently defined life cycle is:

1). Conceptual Phase - - This phase is conducted at the discretion of the Service Components without specific approval of OSD. During this phase the technical, military and economic bases for an acquisition program are established through comprehensive system studies and experimental hardware development and evaluation. It includes the early conception of new systems and the program execution required to provide the technology necessary to make the concept technically feasible.

2). Validation Phase - - This is the phase in which the major program characteristics, through extensive analysis and hardware development, are validated and is often identified with Advanced development. It is preferred that reliance be placed on hardware development and evaluation rather than paper studies, since this provides a better definition of program characteristics, higher confidence that risks have been resolved or minimized and greater confidence in the ultimate outcome.

3). Full-Scale Development Phase - - During this phase, the defense system including all the items necessary for its support is designed, fabricated and tested. An essential activity of

the development phase is test and evaluation, both that conducted by the contractor and the Service components.

4). Productive Phase - - During this phase, the defense system is produced for operational use.

5). Deployment Phase - - During this phase the defense system is provided to and used by operational units. The Research, Development, Test and Evaluation (RDT&E) program structure used in the Department of Defense is predicated upon the methods of budgeting used to fund certain phases of the acquisition.[2]

Technical requirements of the various types described in the expanded Strayer/Lockwood taxonomy (hereafter simply called the taxonomy) flow through the development part of the life cycle which ends at the early part of the production phase. The conceptual phase contains mostly Mission Requirements and aggregate system Operational Characteristics while the other extreme of the development phase, the early production period, contains the greatest number of all types. The general observation that all requirement types grow in number through a technical development, but that they do so at different rates provides a starting framework to study relationships.

Perspective on Growth

It can be said that knowledge is derived by fitting of observations to a usable conceptual framework. The first half of the conceptual model is the testing of concept against observation for the proposed

elements of the taxonomy. This reduces to questioning whether readily accessible requirement documents reflect these requirement types or not. Once it is established that elements can be adequately discriminated, the relational aspects become important. The second half of the conceptual model uses a requirements growth framework. Within that framework, it is believed that some requirement types show independent and predictable trends beyond the most basic assumption of universal growth. Mission Requirements are thought to be virtually independent of time. Design Requirements are considered to start quite small in number and grow faster than any other category. Operational Characteristics and Interface Requirements should show growth patterns between these two extremes. Acceptance of this conceptual pattern for growth of the requirement types leads to a generalization in two parts:

1). existance of predictable patterns reflects that requirement growth conforms to order, and

2). the proposed patterns of growth are a specific form of that order.

This second half of the conceptual model is tested by first counting the number of requirements in each category at a common starting point in some document com-

mon to different programs. Subsequent counts of these requirements are made for each category in each program, thus giving a growth profile. With these data, the first evaluation is of the basic bi-variate relationships of each category with time. Subsequently, the multi-variate relationships among categories are investigated.

Results of the analysis are intended to lead to support of the proposed patterns of growth and thus of the general statement that all requirement growth conforms to order.

CHAPTER THREE ENDNOTES

1. Reference Daniel Strayer and Lyle Lockwood's article "What Are We Buying Here?, page 4 (Bibliography number 52).

2. See Harold Barker and Charles Creighton's thesis "Service/OSD Interface in the Initiation of Major Defense Systems Acquisition", page 44 (Bibliography number 2).

CHAPTER FOUR - DEFINING THE CASE AND PICKING THE RESEARCH SITE

The conceptual model, built on the historic and academic background studies which preceded it, has already formed a basic outline of research:

1). Air Force development programs are used,

2). technical requirements defined in the taxonomy are elements of the study,

3). project offices in the Air Force are the locus of the study, and

4). requirement type growth over a project life cycle is the studied relationship between elements with a specific growth pattern postulated.

A sharpening of focus is necessary in defining a case rooted in concept, yet observable in existing data. Choosing the proper target for a study is an exercise in "epistemic correlation". According to adaptation of a F. S. C. Northrop idea, the conceptual model is described in terms of "concepts by postulation" with the meaning of the conceptual relationship expressed in formal deductive theory terms. Case data are gathered in an operational model which is highly specific to the specific target. This model is therefore expressed in terms of "concepts by intuition" where "the complete meaning of which is given by something which can be im-

mediately apprehended".[1] A problem can arise if the specific operational model, while valid to the particular organization selected, is no longer reflective of the more general deductive theory. The process of insuring that a model based on "concepts by intuition" properly reflects a model based on "concepts by postulation" is described as epistemic correlation.

The following sections of this chapter justify and relate the selected study targets to the concepts they are supposed to mirror.

Placement of the Study in the Life Cycle

The previously discussed phases of a program life cycle bear closer scrutiny. The conceptual phase is subject to some variation from project to project. Normally however, the variation is in the length of time the phase consumes rather than the requirement type content. The validation phase begins with the few Mission Requirements and Operational Characteristics derived during the conceptual phase and ends with almost the final set of numbers in each requirement category. While these requirements are evaluated and changed during the full-scale development phase, the emphasis during this phase is on change, not growth.

Because of the time span between concept and pro-

duction, and because different Air Force groups in the hierarchy control requirements using different documents throughout the time span, it is virtually impossible to find one coherent, yet common, set of documents to cover the whole life cycle for many projects. If one had to constrain his search to documents in only one phase, the validation phase would appear to be most appropriate since the majority of program change occurs during it.

In project offices, a common document used during the validation phase is the Critical Item Specification. Exhibit One shows a general format for Critical Item Specifications as well as higher order specifications. Each hardware or software component which can be individually identified (beyond a certain very low level) has one of these specifications.

During the early and middle parts of the acquisition phase, the Critical Item Specification is written primarily in functional terms since it reflects not actual hardware or prototype but only a growing concept of what the item should be. This document is called the Part One Critical Item Specification. After a formally designated review in the concept development called a "critical design review", this document is re-drafted into a more detailed description document called a Part

Two Critical Item specification. In the case of the Part One specification, emphasis is on evolution of the concept; in Part Two specifications emphasis is on making the concept producable. The Part Two specification builds on the evolution already incurred by the Part One specification since its initial version reflects the evolved baseline of a string of Part One revisions. Use of the Part One is thus preferred over the Part Two when evaluating requirement growth since use of the latter only obscures the great progress already accomplished in the Part One.

Use of both specification parts would be the preferred research alternative but the extreme volume of requirements in a typical Part Two specification suggests that it not be counted unless really necessary for the research to be meaningful. The previous rationale concerning concept development and producability attainment being the respective specification goals, argues that the most sensitive specification to growth in requirements is the Part One. This true because of the general Air Force policy which makes weapon systems requiring advanced manufacturing techniques and materials rare. If the hypothesis concerning orderly growth is not borne out by the more change sensitive Part One spec-

ification, then expansion to the Part Two is not likely to change the results. Accordingly, Part One specifications are used.

Selection of the Research Site

There are three Air Force locations with enough projects to allow an adequate base of evaluation: Space and Missile System Organization in El Segundo, California; Electrical Systems Division in Boston, Massachusetts; and Aeronautical Systems Division in Dayton, Ohio. While there are differences in the programs at the various sites, all face common problems of uncertainty and all use essentially standard management systems. Of the three sites, Aeronautical Systems Division was selected. The Major reason for selection was the large number of projects. A second reason was the ability to gain access to projects because of the researcher's acquaintance with several of the major program leaders and staff.

Selection of the Projects

Earlier, the distinction between programs and projects was made. Another general distinction even among projects, is size. Smaller projects can be documented with one single Critical Item Specification. These projects avoid the complication of having a hierarchy of specifications with extensive cross-referencing

between them. Requirement counting is especially difficult in such a case because one reference to another specification may actually reference a number of requirements. Small projects are therefore a prime target. Another selection criterion used is the avoidance of more than one specification authored by the same person. In a small sample, such as this is, personal bias can be significant. This, of course, should also be true for the contractor's side. While they usually do not write the original specification, they are generally most responsible for the change words. Any project evaluated for change over time, must have a document reflecting at least one revision. Since there are projects, mainly small ones, which stray from the classical documentation route, this becomes a concern and serves as yet another criterion for project selection. A project showing documents with several revisions is naturally preferred to one with less changes.

Major organizations in various functional areas exist in Aeronautical Systems Division. Each has an array of projects under it. Discussions with several senior staff members prompted the conclusion that a technical understanding of the work analyzed would be highly beneficial in evaluating possible specification anomolies. In many of the highly specialized areas of

technical development, the knowledge of what is atypical is derived principally from specific experience in that field. The area of avionics was accordingly picked to best fit the researchers background. The term "avionics" attests to the degree that technical complexity has grown. Although a common term in Air Force technical circles, it was not included in dictionaries as late as 1966, and its 1978 dictionary definition carries the old connotation of "avionic electronics". The total field of aviation electronics includes flight instrument electronics, special purpose weapon electronics, and a class of electronics associated with navigation, weapon delivery and aircraft active and passive defense systems. This last class of electronics is the currently accepted definition of avionics.

The combination of all these criteria, serves to limit the available pool of projects. The major limit on the number of projects, however, occurs on the data collection and analysis side of the question. Requirement counting is a lengthy and, at first, an iterative process. This necessitates a further limit on the number of projects to a number within the available pool. The number of seven projects was picked after the first iteration of requirement counting was completed.

The implications of using seven projects do not

concern the requirements for statistical significance, as one might originally suppose. As will be shown in a later passage, the number of data points taken for each requirement type allows the statistical laws to operate to give a valid significance level. Rather, the problem is basically one of data homogenity. Requirement growth patterns are considered to be predictable over time, even though different agencies work on them, and consistant among projects, even though different leaders are involved. Because of this, the Mission Requirements (for instance) of seven projects can all be summed and treated as one sample. Use of a limited sample of projects does not test the underlying assumptions of homogenity rigorously. A consistant, but unrecognized bias in selecting projects for research could conceivably eliminate those projects evidencing leadership or agency influence. Thus a general and broad claim concerning requirement growth would be supported by a narrow and non-typical sample. This would be a classical ca f improper epistemic correlation.

Project Versus Case Selection

Once one determines the number of projects to be evaluated, he can go two ways in using the data. Data collection procedures must be tailored to the type of

analysis anticipated so the analysis method must be considered as an early part of defining the case. One way to analyze the data is to use each project as a case unto itself. Possibly, there exists interesting differences <u>between</u> the projects even if all seven combined lead to some common conclusions. The study would then include the differential contributions of each project to the common conclusion, but dwell on the reasons for those differences.

This research starts with a different premise. Its first objective is to discover if there are <u>any</u> common conclusions, regardless of the differential inputs. The potential for one project to unduly bias the small sample is not ignored, but study dwells only on the existence or absence of influence rather than on root causes of the differences. Accordingly, the investigation of undue project influence on the sample is handled by the discriminating methods of residual analysis and plotting of outliers.

Using this relaxed objective of only searching for common conclusions has a statistical advantage. The sample size can now be based on the aggregate of projects, rather than individual ones. One can thus assume that every observation of any particular requirement

type is tied to any other observation of that type by time and not by project. As an example: if one were to observe Mission Requirements at time zero on a project by project basis, he would have seven cases, each with one observation. If he were to observe all samples at time zero (which incidentally come from seven projects) he would have one case with seven observations. The sample size is thus expanded by this expedient. It should be noted that this treatment of data does not require one to accept the premise that there are no differences between projects; rather, the chosen premise is that, despite potential differences, there are prevailing tendencies common to all projects.

To this point, the discussion has centered on the statistical advantages of combining data into an enlarged base not possible when evaluating on a project basis. These advantages come only by leaning heavily on the assumption of data homogenity. This is necessary because even if the results derived from the supposed homogenous data does show marked common tendencies, it does not confirm homogenity for the general theory involving all requirements, unless the sample of projects is reflective of the whole population.

The three major confounding influences to data homogenity are involvement by different agencies in the

evolution of requirements, differences of product use (such as satellite versus aircraft), and differences of diverse project managements in the controlling of requirement growth.

Although different agencies are involved in a development, their direct control is virtually all in the conceptual phase and their product is mostly a list of Mission Requirements. The major difference among projects initially controlled by different agencies is reflected in the different numbers of initial requirements and not in the subsequent growth process.

Both Air Force history and academic analysis confirm that project management is basically differentiated by uncertainty and complexity from other management efforts, and that within this category, many common problems and solutions occur for a wide spectrum of products and company managements. Within the Air Force, this commonality has been further reduced to a code in manuals, regulations, and other restrictions and guides generally applied across all projects. In order to believe that differences are more prevalent in Air Force projects than similarities, one must believe that Air Force project leaders and workers grounded in common backgrounds, facing common environments of uncertainty and

complexity, and complying with essentially common management and reporting requirements still wield overwhelmingly diverse impacts on the requirement growth process. A necessary premise for maintaining homogenity is that Air Force projects have common tendencies, not that they are identical relative to requirement growth. Logic and observation support this premise.

Orderly Growth

The concept of orderly growth must be stated more directly in order to be tested. Orderly growth is evidenced by linear relationships between independent variables and time, and by linear relationships between combinations of variables using one of their group as the dependent variable. Transformations are available, if necessary, to accommodate curvilinear data.

CHAPTER FOUR ENDNOTE

1. See Hubert and Ann Blalock's book Methodology in Social Research, page 10 (Bibliography number 3).

CHAPTER FIVE - RESEARCH ORGANIZATION AND ANALYSIS

Data are produced by processing raw information. Part one Critical Item Specifications, which contain written requirements, and numbers of requirements, by type, are generated. This process is done on each revision of each specification, and the time from initial specification publication is tagged to each observation. All observations of an initial specification are tagged with a time zero.

Use of Producible Data

The selection of a part one Critical Item Specification is relatively simple, since few other documents are consistantly available among projects. Not only is the document available, but its use carries a requirement for a formalized system of control, including change control and filing. The other alternative to Critical Item Specifications is a document called the Statement-of-Work. This states what work is required of the contractor in a highly structured format which follows closely the hardware component breakdown. It is therefore a point by point statement of the work necessary to meet the technical requirements. It is an indirect measure of requirements as opposed to a Critical

Item Specification's direct measure. Further, the Statement-of-Work is written in general terms so as to not need changing as technical details are added to a product baseline. It is a poor indicator of growth.

Counting Versus Sampling

The decision between counting or sampling requirements from the specifications is essentially one of extending the usefulness of this dissertation beyond the immediate conclusions. If a sampling system can be devised and shown to accurately reflect actual requirement counting, then other researchers need only sample when investigating relationships. Whether counting or sampling becomes the recommended procedure, it should be recognized that counting is a necessary present feature. The sampling system can only be justified on the basis of its parallel results to counting.

Data Collecting Procedures

Data are collected from the specifications using a process described in Appendix Two. In keeping with an earlier charge to maintain an epistemic correlation as a bridge between concepts and observed data, the conceptual definitions of requirement types are modified to reflect their typical appearance in Critical Item Speci-

fications. These are not changes which delete any element of the conceptual definition, but rather are additions which make the conceptual definitions more precisely tailored to the document:

Mission Requirements in Critical Item Specifications are often included in the introductory paragraphs. Unlike the top specification of an entire weapon system, Critical Item Specifications generally describe a product designed to be used with something else. Further, the product is often a replacement for a previous obsolete unit. Relational statements concerning other interfacing units are thus common and Mission Requirement statements of Critical Item Specifications are usually not as complete and adequate as those for an entire weapon system. Relational statements must, in this unique instance, be counted as Mission Requirements.

Operational Characteristics in Critical Item Specifications initially describe the functions of each component in brief passages. Subsequently the major operational relationships between components are described.

Design Requirements in Critical Item Specifications are often specific and inflexible requirements about the most critical performance features. They are often intended to put a floor on performance at the level of current comparable units to insure getting a product which will give comparable or better overall performance. Since one detailed Design Requirement often directly constrains interfacing components, it is not unusual to see clusters of Design Requirements around a particular required performance capability.

Interface Requirements in Critical Item Specifications are usually first seen as a functional interface diagram. Interface Requirements in the rest of the specification seem to exhibit no pattern of early or late inclusion.

Two-Fold Nature of the Study

The conceptual model has two parts. The first part, comprising the elements of the study, is the investigation of the taxonomy to see if the conceptual elements can be identified and counted in specifications. The second part is the relationship assumed between these elements, that of orderly growth. Research of the data taken from specification requirement counting parallels the conceptual model with an analysis of the requirement counting process coming first, followed by linear regression analysis of element relationships. The basic organization of the requirement counting process is given in Appendix Two.

The Regressions

The regression analyses use The University of Texas at Austin's computerized version of "The Statistical Package for the Social Sciences, second edition."[1] The specific relationships investigated are:

1). Mission Requirements with time;

2). Operational Characteristics with time;

3). Interface Requirements with time;

4). Design Requirements with time;

5). Mission Requirements with Operational Characteristics, Interface Requirements, and Design Requirements;

6). Operational Characteristics with Mission, Interface, and Design Requirements;

7). Interface Requirements with Mission Requirements, Operational Characteristics and Design Requirements; and

8). Design Requirements with Mission Requirements, Operational Characteristics and Interface Requirements.

Positive relationships of each requirement type with time are the simplest expression of orderly growth and therefore are important. Mission Requirements should show virtually no growth at all, with Operational Characteristics through Design Requirements showing increasingly steep slopes.

The multivariate relationship can provide the accuracy of prediction not available in simpler bivariate equations. Analysis of the multiple relationships, especially the residual analyses and the variance/covariance matrices can give major insights to the patterns of growth and especially the effects of multicollinearity.

The projects which provide the data are listed in Appendix Four. The raw data input to the linear regressions are shown in Table One. Organization of that

TABLE ONE

REQUIREMENT TYPES - RAW COUNT OF 23

TIME	MISREQ	OPCHAR	DERSS	INTERFACE
0	11	61	143	18
0	8	69	364	26
0	9	117	531	120
0	3	16	275	62
0	11	63	286	39
0	6	229	149	62
0	8	121	94	43
4	8	127	101	45
5	8	150	133	56
5	11	65	302	40
7	6	341	340	81
13	7	360	632	104
14	9	85	603	37
15	11	86	252	32
15	9	120	585	123
16	11	71	336	47
17	8	176	149	68
21	3	19	292	79
22	8	238	192	89
29	11	75	422	47
32	4	31	335	93
34	11	76	438	48
51	4	44	427	120

NOTE: The following acronyms are used throughout the tables in this dissertation:

MISREQ - - MISSION REQUIREMENTS

OPCHAR - - OPERATIONAL CHARACTERISTICS

DERSS - - DESIGN REQUIREMENTS

INTERFACE - - INTERFACE REQUIREMENTS

data is chronological by months. All data relationships are presented without missing data. Thus correlation of any two requirement types such as Mission Requirements and time is made using pairs corresponding to the number of data "points" or observations. Twenty-three data points in the computer run translate to twenty-three pairs of Mission Requirement and time. The results of running the raw data in the linear regressions is shown in Appendix Five. Table Two gives some of the selected results. When evaluating the results shown in Table Two, the single most striking observation is the smallness of the bivariate correlations of each requirement type with time. When the projects were plotted individually, the requirement types exhibited a stronger correlation with time than the aggregate data indicated.

Transformation

After reflection, it seemed that when each project's contribution was compared with other projects, the very large differences in the initial numbers of requirements in each category swamped the regression and obscured the trend. In two requirement types, the differences in total initial numbers approached one order of magnitude. It is probable that if each project had started with a common base number at time zero,

TABLE TWO

SELECTED COMPUTER RESULTS - 23 RAW DATA POINTS

BIVARIATE CORRELATION COEFFICIENTS

OPCHAR	-.02328			
DERSS	.06743	.00954		
INTERFACE	-.49910	.30396	.44441	
TIME	-.18808	-.17663	.33421	.39799
	MISREQ	OPCHAR	DERSS	INTERFACE

MULTIVARIATE RELATIONSHIP OF MISSION REQUIREMENTS

MISREQ = -.6274 INTERFACE + .6401 DERSS + .6074 OPCHAR + 9. 3317

F SCORE = .023

R SQUARE = .3873

the resulting growth would have been closer to the intuitive results seen in the project plot. A transformation was done on the data. Each observation in every requirement type category was divided by the initial requirement number in that category thus making the transformed data a rate of growth figure on the base one. It was recognized that this made the measurement a ratio which carries its own special burden in statistical analysis, but it was felt that these potential problems could be dealt with effectively. Table Three shows this transformed data. The resultant computer run is given in Appendix Six. Selected results from that run are shown in Table Four.

Sample Size

Previous considerations of sample size concerned the goals of the research and led to an increased size from the original base because of the understanding that aggregate conclusions rather than differences between projects were desired. The first two data runs occasioned a second opportunity to consider the way data are fitted. When the common denominator for data observation shifted from the project to time no consideration was given to whether the original data collection methods were still appropriate. Had the research

TABLE THREE

TRANSFORMED DATA - - COUNT OF 23

TIME	MISREQ	OPCHAR	DERSS	INTERFACE
0	1.00	1.00	1.00	1.00
0	1.00	1.00	1.00	1.00
0	1.00	1.00	1.00	1.00
0	1.00	1.00	1.00	1.00
0	1.00	1.00	1.00	1.00
0	1.00	1.00	1.00	1.00
0	1.00	1.00	1.00	1.00
4	1.00	1.05	1.07	1.05
5	1.00	1.24	1.32	1.32
5	1.00	1.03	1.06	1.03
7	1.00	1.50	2.28	1.31
13	1.17	1.57	4.24	1.68
14	1.11	1.23	1.66	1.42
15	1.00	1.41	1.76	1.78
15	1.00	1.03	1.10	1.03
16	1.00	1.13	1.17	1.05
17	1.00	1.45	1.48	1.58
21	1.00	1.19	1.06	1.27
22	1.00	1.72	1.90	2.07
29	1.00	1.19	1.48	1.26
32	1.33	1.92	1.22	1.50
34	1.00	1.21	1.53	1.23
51	1.33	2.75	1.55	1.93

TABLE FOUR

SELECTED COMPUTER RESULTS - 23 TRANSFORMED DATA POINTS

BIVARIATE CORRELATION COEFFICIENTS

OPCHAR	.78996			
DERSS	.33339	.36964		
INTERFACE	.50680	.85118	.58529	
TIME	.62734	.79290	.24143	.65379
	MISREQ	OPCHAR	DERSS	INTERFACE

MULTIVARIATE RELATIONSHIP OF MISSION REQUIREMENTS

MISREQ = .3436 OPCHAR - .2839 INTERFACE + .50081 DERSS
+ 89.371

F SCORE = 0

R SQUARE = .79329

been done originally on a time basis, it would have required that for every pre-set point in time, data be taken across the spectrum of requirement types for each project. Thus, if project A was the only project to change at time X, all other projects would still have to be counted at time X, even though unchanged. This led to an array of data as seen in Table Five. The resultant computer run is shown in Appendix Seven. As in the previous case, selected results are incorporated in this section in Table Six.

Evolution of the Final Model

When the transformed and expanded data base is analyzed, the results are markedly different from the raw data runs originally tried. While simple bivariate relationships with time are still not high, they have now increased to better than .5 in three out of four cases. The significances of all relationships is quite high, indicating a good fit of the data to the resultant equations. R square for the multivariate relationships are better than .8 for all except Design Requirements which is .61. The residuals of Y estimated values versus Y observed values for the multivariate equation describing Mission Requirements show five outliers which involve 7.81 percentum of the total number of points sampled.

TABLE FIVE

TRANSFORMED DATA - COUNT OF 65

TIME	MISREL	OPCHAR	DEFSS	INTERFACE
0	1.00	1.00	1.00	1.00
0	1.00	1.00	1.00	1.00
0	1.00	1.00	1.00	1.00
0	1.00	1.00	1.00	1.00
0	1.00	1.00	1.00	1.00
0	1.00	1.00	1.00	1.00
0	1.00	1.00	1.00	1.00
4	1.00	1.05	1.07	1.05
4	1.00	1.00	1.00	1.00
4	1.00	1.00	1.00	1.00
5	1.00	1.00	1.00	1.00
7	1.00	1.00	1.00	1.00
13	1.00	1.00	1.00	1.00
14	1.00	1.00	1.00	1.00
15	1.00	1.00	1.00	1.00
5	1.00	1.24	1.32	1.32
5	1.00	1.03	1.06	1.03
5	1.00	1.00	1.00	1.00
5	1.00	1.00	1.00	1.00
13	1.00	1.00	1.00	1.00
13	1.00	1.00	1.00	1.00
15	1.00	1.00	1.00	1.00
7	1.00	1.50	2.25	1.33
7	1.00	1.24	1.33	1.33
7	1.00	1.03	1.05	1.03
7	1.00	1.00	1.00	1.00
13	1.00	1.00	1.00	1.00
14	1.00	1.00	1.00	1.00
15	1.00	1.00	1.00	1.00
15	1.17	1.57	4.24	1.68
13	1.00	1.24	1.32	1.30
13	1.00	1.03	1.00	1.03
13	1.00	1.00	1.00	1.00
14	1.00	1.00	1.00	1.00
15	1.00	1.00	1.00	1.00
14	1.11	1.23	1.46	1.42
14	1.00	1.00	1.00	1.00
15	1.00	1.00	1.00	1.00
14	1.00	1.03	1.06	1.03
14	1.00	1.24	1.32	1.30
14	1.17	1.57	4.24	1.65
15	1.00	1.41	1.76	1.78
15	1.00	1.03	1.10	1.03
15	1.00	1.03	1.06	1.03
15	1.00	1.24	1.32	1.30
15	1.00	1.00	1.00	1.00
16	1.00	1.13	1.17	1.05
16	1.00	1.24	1.32	1.30
16	1.00	1.00	1.00	1.00
17	1.00	1.45	1.48	1.58
17	1.00	1.13	1.17	1.05
17	1.00	1.00	1.00	1.00
21	1.00	1.19	1.06	1.27
21	1.00	1.13	1.17	1.05
21	1.00	1.45	1.48	1.58
22	1.00	1.72	1.90	2.07
22	1.00	1.19	1.06	1.27
22	1.00	1.13	1.17	1.05
29	1.00	1.19	1.48	1.26
29	1.00	1.19	1.06	1.27
32	1.00	1.19	1.48	1.26
34	1.00	1.21	1.53	1.23
32	1.33	1.92	1.22	1.50
34	1.33	1.92	1.22	1.50
51	1.33	2.75	1.55	1.93

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TABLE SIX

SELECTED COMPUTER RESULTS - 64 TRANSFORMED DATA POINTS

BIVARIATE CORRELATION COEFFICIENTS

OPCHAR	.79928			
DERSS	.40676	.45452		
INTERFACE	.54741	.87447	.64128	
TIME	.52805	.66998	.16147	.52342
	MISREQ	OPCHAR	DERSS	INTERFACE

MULTIVARIATE RELATIONSHIP OF MISSION REQUIREMENTS

MISREQ = .3811 OPCHAR - .3056 INTERFACE + .4824 DERSS
+ .87421

F SCORE = 0

R SQUARE = .81078

Three of these outliers are from the same program. On a subsequent trip to Wright-Patterson Air Force Base, this project was again examined. A change in the basic mission of this critical item had occurred subsequent to the first submission of the Part One specification. This fact had been known early in the research but a decision was made to leave it in. The change had been directed early in the project and, given the fact that the project was a long one, it was thought that the several specification revisions would allow a graceful accommodation of the various requirement types to the new direction, but this did not happen. Accordingly, data from this particular case were dropped from further consideration. The sample size dropped from sixty-four to sixty.

A computer program was now run with the sixty remaining data observations, but with raw data (see Appendix Eight). This was done to check the model sensitivity to the extreme data. The original rationale for transformation did not consider the possibility of isolated erroneous data acting as a strong force because of the small number of projects involved. Its conclusion, in fact, was that patently valid data, beginning from greatly different initial bases, had the common trends obscured. If removal of one anomolous set

of observations significantly changed the raw data correlations, even if the results were not as good as the transformed data, then a major blow would have been struck to the rationale for transformation. The results of the second raw data run were similar to the first raw data run with very low correlations with time and generally poorer statistical significances than transformed data as shown by the F scores. When the transformed data were run with the extreme data removed, only two outliers were found. This program was used for the major findings. The program is located in Appendix Nine and is discussed in the chapter on research findings.

The statistical techniques used in the multivariate analyses is principally analysis of variance using the computer's ANOVA routine. The ANOVA routine is basically an analysis of variance technique adapted for computers. It is based on partitioning of the variations of sums of squares of data conforming to factorial design. Linear regressions are investigated using this technique by noting the sum of squares of the residuals to that of the total regression. These values, adjusted for each figure's calculated degrees of freedom, are compared in an "F" ratio. The significance figure derived from tabulated F ratios gives the probability that a

null hypothesis exists that there is no linear relationship of the tested data. This technique is used for regression equations and for individual coefficients in the equations. Immediately below the F ratio analyses of a given relationship (as shown in the ANOVA computer print-out), the prediction equation is derived for the dependent variable. This, coupled with an earlier print-out of R square and standard deviation of the regression line defines the relationship. Several major options, including plotting of residuals, analysis of those data using Von Neumann and Durbin-Watson tests, correlation coefficient tables, and variance/covariance matrices are also offered by the ANOVA routine.

Step-wise inclusion of the independent variables into the model is used because this is the most general test and it allows insight into the dominant independent requirement type in predicting a dependent requirement type variable. This decision is even more appropriate when combined with the second decision to not specify a tolerance level for inclusion of independent variables into the model. All variables are ultimately input to the model.

Multicollinearity Investigations

It is reasonable to hold a starting assumption that certain requirements, such as Mission Requirements,

might directly influence the numbers of other requirement types. The bulk of the earliest requirements (seen in the early conceptual stage) are Mission Requirements. Further, the accepted practice of establishing precedence among specifications and among paragraphs in specifications, has been observed to attach importance to Mission Requirements out of proportion to their number. Taking two observations made about Mission Requirements to a level of abstraction, one could say that requirements that are established first in a chronological sequence and which are also deemed most important in case of requirement conflict, are most likely to force growth in requirements which come and are less important. Mission Requirements fit the "early" and "important" criteria and thus might force requirement growth in other requirement types. It can be seen that any argument that involves time, importance and requirement type, as they relate to requirement growth, is tenuous because it implies a cause and effect relationship based solely on a closed system of requirement types. This was a major consideration in not specifying a method other than stepwise inclusion for insertion of independent variables into regressions. The potential relationships cannot be ignored when investigating multicollinearity, however. Both the bivariate statistics and the variance/

covariance matrices give insight to this problem. Under the closed system, Mission Requirement causal theory, one should see the strongest multicollinearity relationships cascade down from Mission Requirements to Operational Characteristics to Interface Requirements to Design Requirements. A healthy multicollinearity between them all should therefore be found. A result showing orderly growth of the requirement types without multicollinearity does not hurt the orderly growth argument but it destroys the posited closed system. A complicating relationship to this analysis is that of Interface Requirements to Operational Characteristics. Strayer and Lockwood did not see enough difference in these two categories to separate them in their original taxonomy. If they are right, multicollinearity between these two categories should be extremely high. Multicollinearity plays such a big role in the conclusions of this research, that further discussion is held for the chapter findings.

Autocorrelation Investigations

Time series classically contain some or all of four types of movement. One author defines these as secular trend, periodic variation, cyclical movement, and irregular fluctuations.[2] The key to how one views

a time series is directly tied to his primary interest. In business, the secular trend is very often a simple reflection of population growth. Beyond this are the periodic variations such as seasonal influences. Often, when one controls for these two influences, he can see, for a given industry, that it runs in cycles. A businessman may wish to know where he is in a cycle or he might want to know what to expect from the Christmas rush. Depending on what he wants to know, he will control or suppress certain effect.

This analysis starts with a different focus. The aim is not to control the regression for some known trend in order to isolate independent effects, but rather to determine if the data indicates some secular, but unknown trend at work. The original belief concerning what caused order to be established in a system, was that certain forces like uncertainty, size, cost, and complexity set an initial burden on a development. The system responded in an orderly manner with Mission Requirements leading the process. If these external forces do not just set the initial conditions, but continue to act throughout the development, they will be seen as secular trends and will probably emerge in tests for autocorrelation.

Autocorrelation is checked using the Durbin-Watson Test and the more sensitive Von Neumann Ratio. Further, the effects of entering time as an independent variable is indicative and is investigated (see Appendix Ten). The results do not support findings of any significant autocorrelation in the data. The Durbin-Watson Tests and Von Neumann Ratios are generally negative with the only exceptions showing mixed results between the two tests in two cases. The inclusion of time as an independent variable improves correlations only at the fourth decimal, leading to the conclusion that any time based trend is not significant. These findings are not surprising, when considering the classical way a program is defined relative to these potential secular forces. While the state of the art of technical development increases with time, the effect on a program is minimized by tight control. Virtually all programs are required to assess their technical risk early in the development, and those with high risk are usually redefined. Development programs which push the state of the art are universally discouraged. A program starts with a certain (although sometimes unknown) degree of uncertainty, complexity and size. It generally proceeds to certainty. Changes involving obvious increases in complexity are

discouraged. Increases in size of the product, or the program are discouraged, although they do happen. It is logical to assume that control over these forces is better on the smaller and simpler projects and that is what the data support.

CHAPTER FIVE ENDNOTES

1. See Nie, Hull, Jenkins, Steinbrenner, and Bent's book *Statistical Package for the Social Sciences* (Bibliography number 37).

2. Reference Croxton, Cowden and Klein's book *Applied General Statistics*, page 214 (Bibliography number 7).

CHAPTER SIX - - RESEARCH FINDINGS

Ability to Isolate Requirements in the Taxonomy

The proposed taxonomy is used, not to be normative, but rather because it reflects the natural order of things relative to requirement definition. To this extent, one would expect to see an extensive number of easily recognized classical types for each taxonomy category. This observation was borne out by the study. Even among individual members of one type of document, however, (part one Critical Item Specifications for avionic units) it is apparent that there is an almost endless number of ways to compile requirements which defy their isolation to some conceptually pre-conceived taxonomy. The fact that there is no current Air Force requirement definition system testifies to the license available to specification writers to define requirements any way they wish. The principle normative influence on specification writers has been past experience and especially that in their own functional areas. These specifications are normally organized first by a component breakdown of the critical item and then by a fairly standardized set of additional considerations.

The guiding influence seen in current writing of requirements appears to be (beyond clear statement of the

idea at hand) good transition and integration with the requirements of other paragraphs. The general mechanical characteristics of a piece of hardware appears to have a bearing as well. A piece of hardware can characteristically be broken down into clusters of functionally oriented components which break down into smaller and smaller units. At the functional cluster level there are cross-functional interfaces. Within the clusters there are intrafaces between units and interfaces with units of other clusters. Thus a very simplistic view of a technical description would show that there are functional cross-sections at every level of hardware component breakdown. It is therefore not surprising that there are numerous requirement statements which do not fit the taxonomy cleanly. The distinction, however, does not seem to be that there are better theoretical categories possible, but rather that there is such overlap between the postulated types.

If one assumes that there are significant populations of requirement statements clustering around each conceptual requirement type, and that all other requirement statements are on a continuum between any given two requirement types, the problem becomes one of limits and sensitivity. Limits are necessary to arbitrarily resolve at least some of the grey areas back

into black and white. Sensitivity analysis is necessary to determine how much of a specification analysis is covered by classical fits and how much arbitrarily moved out of a grey area. Table Seven shows the count made on one project concerning classical fits to the taxonomy categories. The table is a device to present the subjective judgement made concerning requirement type fits, and the appearance of precise numbers and percentages should not carry more weight in the mind of the reader than intended. What the table _is_ intended to show is that somewhere around one quarter of observed requirements are not clearly associated with any taxonomy element. Previous to this evaluation, there was another effort to arrive at the total number of requirements (both classical fits and grey ones) on the initial program seen. One must assume some form of learning would take place in requirement counting which would make a later count of a specification's requirements different from the first one. Table Eight shows the results of three sequential counts on the initial project. As can be seen, the second and third measures are substantually closer than the first and second. It is recognized that this argument suffers the same weakness as attributed to a Delphi process, namely that convergence of subsequent findings does not necessarily support any

TABLE SEVEN

EVALUATION OF REQUIREMENT TYPES WHICH FIT CLASSICAL DEFINITIONS IN ONE PROJECT

TOTAL NUMBER	11	63	286	39
NUMBER OF FITS	9	37	214	24
PERCENTAGE	.82	.59	.75	.62
	MISREQ	OPCHAR	DERSS	INTERFACE

TABLE EIGHT

REQUIREMENT COUNTING LEARNING CURVE RESULTS

MEASURE ONE	11	48	226	46
MEASURE TWO	11	60	271	39
MEASURE THREE	11	63	286	39
	MISREQ	OPCHAR	DERSS	INTERFACE

conclusion about the appropriateness of the mean converged upon.

Basic Regression Relationships

The basic equations for both bivariate and multivariate relationships are listed in Table Nine. Listed along with the equations are relevant statistical results.

The bivariate relationships show little direct correlation with time. High correlations are found between Operational Characteristics and Interface Requirements (R = .95727) and between Mission Requirements (R = .86721).

The multivariate relationships are uniformly high. Mission Requirements are determined from the other requirement types with an R square of .86689. The significance, as given by the F test, is better than .0001. Individual coefficients passed the T test for significance. Both the Von Neumann and Durbin-Watson tests indicate no auto-correlation.

The operational Characteristics are determined with an R square of .95920 and enjoy the same statistical support except for a Von Neumann Ratio of 1.78642 which indicates possible autocorrelation. The Durbin-Watson test is contra-indicative, however.

TABLE NINE

SELECTED COMPUTER RUNS - BASIC EQUATIONS AND STATISTICAL RESULTS

COMPUTER RUN WITH ALL TAXONOMY ELEMENTS (APPENDIX EIGHT)

Correlation Coefficients

OPCHAR	.47420			
DERSS	.86721	.76490		
INTERFACE	.45174	.95727	.69115	
TIME	.01438	.34225	.14226	.34604
	MISREQ	OPCHAR	DERSS	INTERFACE

Multivariate Relationships

Mission Requirements

MISREQ=.069 DERSS-.206 OPCHAR+.856 INTERFACE+1.052

R square=.86689
F=121.56 Significance=0
Standard Deviation=.01257

Opererational Characteristics

OPCHAR=.542 INTERFACE=.156 DERSS-1.721 MISREQ=2.035

R square=.95920
F=438.86 Significance=0
Standard Deviation=.03635

Design Requirements

DERSS=11.860 MISREQ+3.191 OPCHAR-1.237 INTERFACE-12.8

R square=.93220
F=256.66 Significance=0
Standard Deviation=.16425

Interface Requirements

INTERFACE=1.568 OPCHAR-.175 DERSS+2.069 MISREQ-2.472

R square=.93452
F=266.41 Significance=0
Standard Deviation=.06184

TABLE NINE
(Continued)

COMPUTER RUN WITH INTERFACE REQUIREMENTS AND OPERATIONAL CHARACTERISTICS COMBINED (APPENDIX TEN)

Correlation Coefficients

DERSS	.86721		
OPINT	.46223	.73030	
TIME	.01438	.14226	.34808
	MISREQ	DERSS	OPINT

Multivariate Relationships

Mission Requirements

MISREQ = .062 DERSS - .030 OPINT + .997

R square = .81189
F = 123.0 Significance = 0
Standard Deviation = .01428

Operational/Interface Characteristics

OPINT = .870 DERSS - 8.158 MISREQ + 9.390

R square = .88780
F = 51.997 Significance = 0
Standard Deviation = .24607

Design Requirements

DERSS = 12.317 MISREQ + .630 OPINT - 12.576

R square = .88780
F = 225.58 Significance = 0
Standard Deviation = .20940

NOTE: The combined variable Operational/Interface characteristics is represented by the acronym, OPINT

Design Requirements are determined with an R square of .93320. Here, again, the main disturbance in the supporting statistics is a mixed autocorrelation test.

Interface Requirements show an R square of .93452 and a good autocorrelation test with a Van Neumann Ratio of 2.00295 (2.0000 being the expected value).

Particular Relationships of Interest

The first area of particular interest is that of the high bivariate correlations. These are the first indication of multicollinearity. Beyond giving valuable insight on the requirement type relationships, this finding's primary importance lies in its capacity to potentially confound meaningful use of the multivariate relationships. The high correlation between Operational Characteristics and Interface Requirements (R=.95727) is simply explained and corrected. Strayer and Lockwood's original taxonomy which made no distinction of Interface Requirements from Operational Characteristics is supported by this finding. Further Support is found when one analyzes the variance/covariance matrix for one of the multivariate regressions involving these categories as independent variables. Table Ten shows such a matrix for the dependent variable Mission Require-

TABLE TEN

COVARIANCE TABLE FOR MISSION REQUIREMENTS

(Demonstrating the Close Relationship between Operational Characteristics and Interface)

OPCHAR variance	.00138
INTERFACE variance	.00061
COVARIANCE	.00084

ments. The strength of the covariance outweighs the Interface variance and is better than sixty percentum of Operational Characteristics variance. The recombining of the two covariant variables into a single Operational/ Interface Characteristics variable was done and is shown in Appendix Eleven. Selected statistics lifted from that computer run are shown in the last half of Table Nine.

It was suspected that the computer run with the combined Operational/Interface Requirement variable (Appendix Eleven) would not alter significantly the high bivariate relationship between Mission Requirements and Design Requirements, and this was found to be true. Table Eleven shows that relationship. The covariance between the two variables is seventeen times that of the Design Requirements variance. Unlike the case of Interface Requirements, there is no ready answer for this observation.

Two streams of thought must be explored in searching for an answer. Either there is something in the data or data analysis which is distorting the model, or the model is accurate and a logical underlying reason exists. The data collecting procedures were reviewed and the analysis of requirement fits to classical definitions (Table Seven) was considered. The greatest chance for error in classifying requirements is in the intermediate categories of Operational Characteristics and Interface Requirements as each has a conceptual overlap with two other requirement types. One of those overlaps is with each other, which has been shown to be pronounced. The two end types, Mission Requirements and Design Requirements, are the easiest to define. The

TABLE ELEVEN

COVARIANCE TABLE FOR OPERATIONAL/INTERFACE CHARACTERISTICS

(Demonstrating the close relationship between Mission Requirements and Design Requirements)

MISREQ variance	3.6709
DERSS variance	.0110
covariance	.1739

likely place for making an error having such an impact is in Mission Requirements because of its small numbers. This, however, is the easiest category of all to isolate and count. The data counting procedure was dropped from further consideration. The smallness of the Mission Requirement numbers may cause the category to suffer distortions in the statistical processing used. A requirement change on the base one hundred is a one percentum change. Done on the base ten, however, it is a ten percentum change. If a counting error occured in Mission Requirements, the comparison of raw numbers, while being distorted, would probably not be fatal. When this same data is transformed tc a rate of growth, the error is magnified. Since the requirement categories measured exhibit a difference in numbers approaching one order of magnitude, the possibility exists. Mission Requirements, both conceptually and observed in most projects exhibit no growth from the initial number. A number erroniously chosen at first, will stay with the rest of the counting. The potential for errors which affect growth rates lies in counting the increased Mission Requirements above the established base whether it was counted properly or not. If there is an error, it is likely both conceptually and procedurally to be an

unwarranted increase in the growth rate. Following this logical premise leads one to question just how far away from zero growth the Mission Requirement observations were and if that difference was significant. The difference does not appear large, but one must suspect the sensitivity of a small sample. This sensitivity analysis can be done by assuming the conceptually postulated zero growth for Mission Requirements and running the computer program with this input. If correlation is still high between the two requirement types in this analysis one must seek the answer somewhere else than with Mission Requirement counting of analysis techniques. When this is done (see Appendix Twelve) one sees that the R square drops from .86721 to .79696 reflecting that the vast majority of correlation cannot be related to Mission Requirement errors. It would seem logical at this point that some underlying conceptual reason should be sought.

Three Most Significant Findings

The three most significant findings concerning requirements are:

1) the taxonomy received support as an indicator of central tendencies, but there is a large number of poor fits in each category except Mission Requirements;

2) no support of bivariate relationships between time and requirements is seen, and

3) an unexplained correlation between Mission Requirements and Design Requirements makes, what originally looked like good multivariate regressions, questionable.

The finding that a theoretical taxonomy of requirement types is evident in existing specifications is a positive inducement to continue refining the counting process. Partitioning of the total set of requirements into logical groups is the first step in understanding and controlling requirement growth. Basically put, common requirement types and patterns lead to common solutions.

The finding that bivariate relationships are not strong over time is significant to the assumption of orderly growth. Mission Requirements were expected to be time independent but the other types were expected to have, at least, fair correlations with time and increasing slopes as they progressed through requirement types towards Design Requirements. Both the correlations and slope coefficients of Operational Characteristics and Interface Requirements, while hovering in the .30 range, are not quite in the range expected. The Design Requirement slope coefficient and correlation are clearly not as predicted, being on the same order as Mission Re-

quirements. Some other conclusion than direct and strong relationships of the Mission Requirements causal theory must be considered unless the apparent inconsistancy can be cleared.

The unexplained correlation between Mission Requirements and Design Requirements is significant because it indicates a direction to search in seeking an explanation to the apparent inconsistancy.

CHAPTER SEVEN - - IMPLICATIONS OF THE RESEARCH

The assumption of orderly growth had been established from long standing observation. These observations included the recognition that when a project starts to take shape in the conceptual stage, the type of requirement is almost always Mission Requirements with some gross Operational Characteristics. It is known that a project near completion exhibits a clear majority of Design Requirements with a lesser number of Operational Characteristics. These observations led to the logical premise that more detailed requirements grow from less detailed ones in a decision tree type of pattern.

The correlation of Design Requirements with Mission Requirements and the lack of correlation of either of these to Operational Characteristics makes this proposed pattern unlikely without some modifications.

Possible Alternate Explanations

As the computer run with Mission Requirement growth set to zero showed, the apparent correlation between Design Requirements and Mission Requirements is not caused by Mission Requirements acting unpredictably. A profile of little or no growth is assumed and the data supports it. Design Requirements are postulated to

have the greatest growth, but its pattern is actually indicative of the Mission Requirement low growth profile.

One good reason for low Design Requirement growth might well reside in the use of specifications. Specifications are primarily descriptive documents which show the status of a project's development at some point in time. Specifications are also referenced documents which show the status of a project's development at some point in time. Specifications are also referenced documents on research and development contracts. As such, new or changed specification requirements carry the potential for a change in the agreed effort to be accomplished by the contractor. This effort is defined in the contract statement-of-work which is written in general terms to allow some flexibility for design in conditions of uncertainty. Changes in the statement-of-work normally carry with them cost and schedule increases. These are anathema to a well run project. The specification analog to loose statement-of-work statements is the use of Operational Characteristics. It is possible that cautious managers substitute Operational Characteristics for Design Requirements in their evolving specifications as often as feasible. Operational

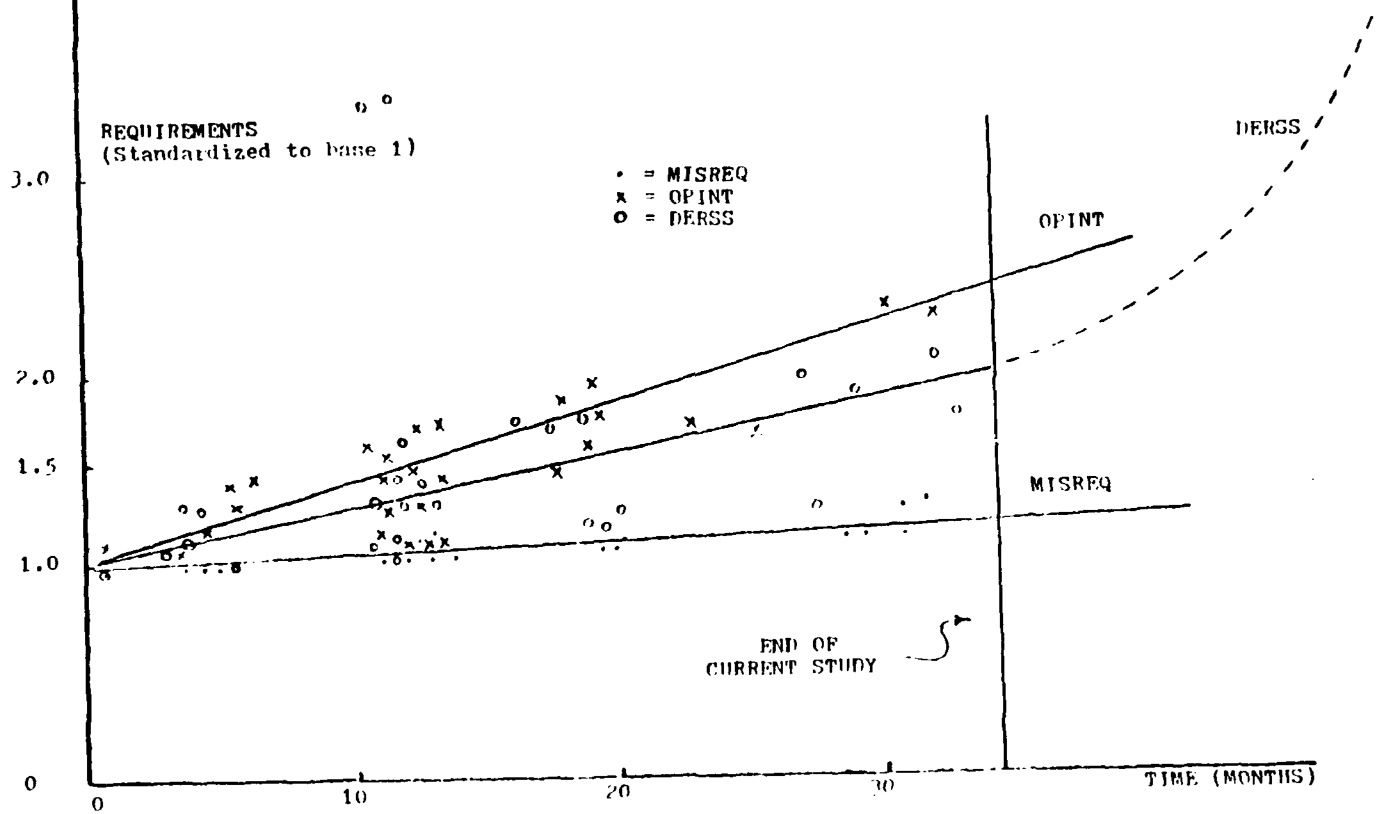
Requirements can usually be met by a variety of Design Requirements; Design Requirements are highly constraining. Since the Design Requirement is normally expected to be the last category of requirement completed, a strategy of filling in the spaces in an evolving specification with relatively flexible Operational Characteristics and of holding off Detail Requirements as long as possible can be used and still give the appearance of a well run and orderly development.

Interface Requirements were originally evaluated because it was believed that an increased level of detail, as a Part One specification evolves, would force resolution in key areas by Interface Requirements. Interface Requirements put Operational Characteristic constraints on one side of an interface. The increase of Design Requirements makes one half of many interfaces firm. This is properly balanced by an increase in Operational Constraints on the yet to be resolved side of the interface. Although Design Requirements did not grow as anticipated, neither did Interface Requirements which conforms to the understanding of the relative relationship.

The problem of interface is thus also apparently controlled at the Part One level by staying with Operational Characteristics as long as possible. Acceptance

of this explanation of the early substitution of Operational Characteristics for Design Requirements and Interface Requirements as the fastest growing category is inconsistant with the originally conceived pattern of growth for each of the categories but does not rule out some type of order in the growth.

When one works with linear regressions in a specified range of inquiry, the natural tendency is to consider extending the regression outside the range. There is one assumption of growth which will make the observed results generally fit the conceptual model but it requires extrapolation of Design Requirements in a curvilinear pattern. Exhibit Three shows this construction. Design growth may be retarded in Part One specifications because of reasons previously given. At the beginning of the Part Two specification, Design Requirements would take off, making the combined Part One and Two pattern reflect an exponential curve. The Part One pattern might be so flat that small samples would parallel the results of a linear relationship. Examining the relevant range of Exhibit Three, one could therefore suppose a high correlation between the apparent straight lines of Mission Requirements and Design Requirements. The observed correlation is .86721. One would suppose



REQUIREMENT GROWTH WITH TIME

EXHIBIT THREE

that since these two categories don't grow much, their correlations with time would be small. The actual correlations with time are .01438 and .14226. One would expect the very least correlation with time to be for Mission Requirements. This is true. Once Design Requirements are assumed to grow exponentially, one would expect Operational Characteristics to show the greatest growth in the relevant range. The actual correlation is the best at .34225. Lastly, one would expect all of these relatively flat lines to relate well with one another which is reflected by the high multivariate relationships.

The model in Exhibit Three proposes a slightly altered but conceptually valid demonstration of orderly growth. It accounts for the apparent conflict between theory and observation of Design Requirements growth by showing how a low measured growth and high perceived conceptual pattern can be reconciled in the relevant range of observation. It is recognized that the leap from research findings to this possible alternate explanation is a leap forward from the data analysis but the conceptual jump is small and supported by observations of the interrelated patterns among the requirement types.

CHAPTER EIGHT - - SUMMARY

In military projects, goals are represented by technical requirements in development contracts. Process is represented by various other contractual requirements and by the management systems in force. A review of public administration history has shown that, through a process described as functional rationalism, the bulk of America's public agencies have lost their perspective on goals because of their preoccupation on the processes used in gaining those goals. Air Force projects constitute a special form of public agency and they evidence manifestations of this common problem.

Specifically, Air Force history has shown a proclivity to rationalize development of a project into formal phases in a life cycle, and to further manage each of these phases according to a series of manuals and management systems. As in the generalized case for public administrations, the harm done is not seen to be inherently incorporated in the particular systems, manuals and life cycle phases but rather in the resultant lack of attention on requirements.

Direct academic research on technical requirements has been scarce. Early studies were marked by emphasis of the uncertainty and complexity inherent in

technical projects. The main thrust of such studies was that the marked uncertainty and complexity of weapon system acquisitions clearly differentiate those efforts from developments in the private sector.

Some writers classified the more important requirements as "technical performance parameters" and proposed systems for their control. Others traced the specific effects on programs of uncertainty and complexity to external and internal sources and emphasized controlling these factors.

Martin, in his 1971 dissertation, used an entropy analog to analyze the amount of information (and accordingly decision alternatives) in a project development. He related this entropy (defined as a measure of the information in a system) directly with the <u>increasing</u> amount of information in a project development and argued that more information inherently meant more choices hence more uncertainty. This led to his adaptation of the second thermodynamic law which says that the tendency exists for a system's entropy to always increase.

Martin's use of an increasing information base appears to be an abstract counterpart to the evolving technical requirement baseline and thus his dissertation is one of the few efforts which addresses requirement

growth directly. Its focus, however, is a "grand scheme" explanation of how uncertainty operates on a highly generalized information (or requirement) growth network. This doesn't allow isolation of specific types of requirement growth.

Following Martin's lead, an analogy to learning theory was investigated. The investigation did not provide a readily usuable framework, as it did in Martin's case, but it served to sharpen the perspective on what should be studied. Learning theory contains two basic, and not completely compatible theories on learning. The Wundtian Elemental school forwards the proposition that items are learned and remembered independently of associations with other ideas. The rote memory work of multiplication tables, spelling tests and the like attest to the widespread application of such a learning theory. The Gestalt school, however, believes that learning and memory depend on interaction of the items in question with other already learned items. One must satisfy himself as to the logical relationship in order to remember. Perhaps the best current example is the association methods taught in memory classes for remembering names and places.

In weapon system acquisition, heavy emphasis

has been placed on the role of complexity in making such developments difficult. This complexity has been shown to grow, in part, as the unanticipated result of combining two requirements which are themselves simple. Thus a synergy effect occurs where the resultant complex problem is greater than the sum of the individual problems. This characteristic is analogous to a Gestalt process where the whole of a problem is more than the summation of its parts, but rather a summation of parts plus associations. Following the lesson of this Gestalt analogy to its logical conclusion, one is led to realize that technical requirements cannot be understood in isolated categories.

The terms "military project" and "weapon system acquisition" have previously been used interchangeably and without further definition. This was done primarily to gather under one roof all of the diverse writings and research in the field which run a gambit from big programs to small projects and from Navy to Army to Air Force.

The conceptual model uses the aggregate comments based on definitions using any one or a combination of these terms to explore the historical development and background. The comments give a direction to search in

making the conceptual model, but if one is to go further, a more precise definition is necessary. The conceptual model uses the technically oriented project offices of the United States Air Force. Each such project office controls the development of a product by one or more technical contractors using development contracts. These contracts include a set of requirements, described by Strayer and Lockwood as:

1) Mission Requirements - - basic statements of product mission,
2) Operating Characteristics - - basic functional statements,
3) Design Requirements - - details on design and specification compliance,
4) Interface Requirements - - added to the Strayer/Lockwood list as functional statements that constrain the interface between two requirements,
5) Management System Specifications - - basic management systems,
6) Legal Obligations - - Walsh-Healy Act, etc., and
7) Programming Requirements - - schedule and funding arrangements.

Each product controlled by a project office is technically defined by the first four requirement types. Control is exercised over a product's development life cycle which includes conceptual, validation, full-scale development, production and deployment phases.

The conceptual model proposes that the various technical requirements are present in commonly used development specifications and that requirements can be isolated and counted such that an aggregate number in each category can be totaled. Further, the model proposes that there is a discernable bivariate trend of growth for each requirement type over time and therefore necessary multivariate relationships as well. The specific patterns of growth are postulated to be linear or a transform function. Specifically, Mission Requirements are seen to remain relatively steady over time. Operational Characteristics are seen to exhibit some growth, Interface Requirements more, and Design Requirements the most.

The case is centered on the validation phase of a project's life cycle. The document selected is the part one Critical Item Specification. The research site is selected as Wright-Patterson Air Force Base in Dayton, Ohio. Projects were selected in avionics because of researcher familiarity with the subject. The number of projects evaluated was established at seven.

Since the thrust of the research is on the common aspects of requirement growth, the identification of requirements by project was relaxed to allow all require-

ments of a particular type to be summed together. This increased the sample size by allowing time to be the one common denominator among samples.

Research findings were not total support of either the process of requirement counting or the conceptual model on interrelations. Requirement types seen in Part One specifications are sortable by category, but the overlap between types is large and discourages precise use of the results. The bivariate relationships of the requirement types with time are not fully in line with the conceptual model in the relevant research range. This range, it should be remembered, is the period of development of the Part One Critical Item Specification in the acquisition phase of a product's life cycle. During this period, Mission Requirements and Design Requirements seem to have highly common growth patterns. The two are highly correlated with each other. The two have commonly low correlations with time. They have similiar slope coefficients. The circumstance of common slope coefficients is important because it strikes directly at the heart of the differential growth hypothesis. Design Requirements were thought to have the most <u>different</u> not the most common slope with Mission Requirements. It is statistically inappropriate to depend on a comparison of common slope coefficients where correlations are so low. The conclu-

sion of common slopes, as seen in the computer results, was accordingly supported using a different approach.

Design Requirements show a high bivariate relationship with Mission Requirements. This means that sufficient linearity exists between the two that one can predict the other with high certainty using a direct mathematical relationship. Going a step further, if one can accurately be measured against time, so can the other. This establishes common tendencies of linearity with time for the two variables, but it does not establish the occurance of common slope coefficients. Further, the common tendency with time, so far, has been seen to be one of low correlation. Addressing this low correlation with time, the Mission Requirement correlation was seen to be low because the data points parallel the X axis, not because of a wide spread of data points. In essence, the data support a strong linear relationship and a well defined slope for Mission Requirements which is truly not correlated with time in that no matter how much time elapses, Mission Requirements are not seen to grow. The high correlation between MISREQ and DERSS accordingly takes a greater significance. Further, evaluation of the Design Requirement data points confirms that they also follow the low scatter, low slope profile of Mission

Requirements. This analysis supports the computer findings of relatively common and low slopes for Mission Requirements and Design Requirements. As again evidenced in the high multicollinearity between Mission Requirements and Design Requirements in the multivariate relationships, Design Requirements are inappropriately related. By using the explanation of an exponential or other sharply rising change in Design Requirements during the Part Two specification development, the study results can be reconciled to a conceptually sound growth theory.

This points up both the limits and the value of this dissertation's results. The research concludes that requirements can be counted and that the simplest model of differential linear growth of requirements in Part One specifications is not valid as postulated. In keeping with the dictum of Occam's Razor- the simplest set of assumptions needed to explain a phenomenon is best- a single change is proposed as a target for future study. Such a future study should start with a validation of the requirement counting process. Appendix Three gives a proposal for doing this.

CHAPTER NINE - - RECOMMENDATIONS FOR FUTURE STUDY

A major purpose of this dissertation is to provide a way for counting, and possibly sampling requirements. Hopes for sampling have been dimmed by the research results because of the apparently large overlap between requirement types. It is possible that more can be done to crystalize the categories such that the overlaps will diminish. To this end, Appendix Three is written to offer suggestions as to how a study of this type might proceed.

In the area of requirement relationships, the obvious first step is to check part two specifications to see if Design Requirements take off in an upward direction as suggested by this research. Other alternatives also follow obvious forms. Expansion of the study across a wider base of avionics is the first step. This serves as a validity check on the results already accomplished. After that, extension to other functional areas can be considered. As sophistication in the counting and analyzing process increases, the research can be extended to large programs where specifications have a lot of interaction among themselves.

No evaluation of the requirements growth process

would be complete without more than passing attention paid to deliberately constraining growth. Interviews with numberous project leaders and staff elicited a common belief that those requirements developed early in acquisition should be held firm. One author[1] emphasizes the early involvement of contractors in writing system specifications as one way to insure that changes are minimized.

Other authors[2] continue a written track of the project managers' consensus on control of growth. They list several "errors" of management. Setting requirements without user involvement is the first type of error. Their subsequent list of errors generally involves changing those requirements without user involvement. Lack of involvement of the using military commands (Tactical Air Command, Strategic Air Command, etc.) is a relatively recent criticism. In fact, the counter complaint that user involvement led to unnecessary changes led to an emphasis on reduced command influence as a cornerstone of the McNamara era. Acceptance of user inputs does not necessarily mean unnecessary requirements, however. The wisdom of what original requirements to hold fast in the face of a rapidly changing environment must take account of the experience of those forced to live (or die) with

results. This research can serve to make the distinction of requirement types more clear and emphasize the large scale implications of changing Mission and high scale Operational Requirements.

CHAPTER NINE ENDNOTES

1. See Dietrich's article "System Acquisition - How A-109 Can Help Shorten the Process" in Government Executive, Volume 9 (Bibliography number 10).

2. Reference Ferratt and Starke's article "Avoiding System Mismanagement" in Journal of Systems Management, Volume 29 (Bibliography number 12).

APPENDIX ONE

BACKGROUND RESEARCH SOURCES

APPENDIX ONE

BACKGROUND RESEARCH SOURCES

The subject of technical requirements growth came as a spin-off to an original interest in control of engineering changes. As a technically complex weapon system is developed, changes to the design are inevitable. These engineering changes are damaging to a program not only because they are inherently costly, but also because they often stretch a development schedule which allows the dual problems of idle engineering capacity and inflation to operate.

One must know precisely the base of requirements at any two points in time in order to properly evaluate the engineering changes occurring between those points. The addition of a new requirement is not a legitimate change. Further, it is probable that the differences in absolute numbers of requirements between programs inherently leads to differences in engineering changes. Larger programs likely have more changes. These two conclusions make it necessary to accurately measure requirements in order to understand engineering changes.

It became immediately apparent that even a sketchy understanding of requirement isolation and counting did not exist. Tracking this problem led to

researchers concerned with the problem and to their organization, the Air Force Business Research Management Center located at Wright-Patterson Air Force Base in Dayton, Ohio. This center was established to coordinate and evaluate research in business oriented procurement methods. The researchers in the center specialize in different functional areas and broker research in their specialty to different Air Force students and agencies. When an avenue of research is particularly promising, funding for private research is considered. Technical requirement growth is the concern of both the center's chief, Lieutenant Colonel Daniel Strayer and of Captain Lyle Lockwood. These two have a good balance of academic background and practical experience. Their paper on the subject called "What Are We Buying Here?" is the basic foundation of the dissertation because of its proposed taxonomy. Beyond this vital research done by Strayer and Lockwood, another resource offered by the center was the collateral studies, many of which are documented in the center's <u>Semiannual Business Research Reports</u>. Using this document and reports suggested by the center staff, the serious work of tracing the background of technical requirement growth research was begun. The process started here is standard in academic

research and involves tracing the bibliographies of relevant documents to other pertinent documents and continuing the process until good sources are exhausted.

This line of research using the center's resources led to the nucleus of research reports and studies for the dissertation.

Two other major resource centers are located at Wright-Patterson Air Force Base. The first is the library of the Graduate School of Logistics. This library is important to the dissertation because it is an Air Force access point to the Defense Logistics Studies Information Exchange. Using the Exchange's descriptor list, a bibliography was established and reports ordered.

The second center is the Air Force Institute of Technology's Engineering Library. Dissertation Abstracts International, while not an exclusive resource of this library is a necessary one to review and is available there. The areas of Business Administration and Systems Management were found to be the most fruitful and were reviewed for similar dissertation topics - - none were found. One almost has to live in the environment of technical engineering management to undertake such a topic so the lack of close subjects was not surprising.

Air University Abstracts of research reports was

reviewed for topics using the categories of System Management, Requirements, Technical Performance Parameters, System Program Management, and Project Management.

Two other sources in the library are the International Aerospace Abstracts and the Keyword Index of AFIT Student Resident Theses. These sources are marked by the fact that the respective bibliographies are not computerized so that they must be entered using keywords and do not allow combinations.

Other sources are more individually tailored. The University of Texas of Texas at Austin's computerized search of journals and periodicals called INFORM was run. The Defense Documentation Center's computerized bibliography was used as well as that of the National Technical Information Service.

The general library facilities of The University of Texas at Austin were used. NASA/SCAN sheets from the National Aeronautics and Space Administration were reviewed and the 81-01 series of Aerospace Management was found to be the best source. Papers and books recommended by committee members were used.

APPENDIX TWO

REQUIREMENT CLASSIFYING AND COUNTING PROCEDURES

APPENDIX TWO

REQUIREMENT CLASSIFYING AND COUNTING PROCEDURES

Assumptions Made in Counting

It is immediately apparent that some of the requirements seen in a part one specification are included more than once. This practice is generally accepted because of the dual nature of specifications. They serve as technical guidance and description, on one hand, and a contractual standard of performance on the other. Requirements are often specified in some places primarily to add context to other requirements but must be repeated later, in the appropriate place, to assure contractual coverage. This repetition is small compared to the total number of requirements and is ignored in the research.

Many standards for design and testing are codified in various Department of Defense specifications and standards used by the Air Force. Each such specification is designed for common application across projects, and hence, compliance over time evokes standard responses to design, test procedures, etc.. Each such standard is assumed to be in the government system if it is listed in the latest *Department of Defense Index of Specifications*. Each such specification or standard is treated as one requirement each time it is reference in a specification.

Procedures

What defines a single requirement? This problem is easy to answer in concept but quite difficult in practice. One should remember that the complex nature of requirements makes statement of relationships and interfaces into compound statements, sometimes involving many parts in order to properly reflect the complex nature of the relationship. One alternative to simplify this situation is a structural content approach. This leans on the idea of sentence diagramming rather heavily. It breaks each sentence into parts and analyzes those parts. The following sentence is presented for analysis:

> The Omega Air Navigation System shall operate at the low-frequency wave lengths in communicating navigation information between aircraft and ground stations over long distances.

In the above sentence, "Omega" is simply a name, yet it is now a government-required label for the system. "Navigation" is a requirement as to function, albeit gross. "System" requires that there be interrelated components of large enough size to warrant being called a system instead of simply a unit. "shall operate" is a requirement for use of the system - - as opposed to only requiring a system mock-up. "low-frequency wave lengths" defines the means of transmission as radio (as opposed to laser, for instance) and it further constrains that operation to

be in the low frequency band. "communicating", when used in conjunction with "between", requires two way transmission. This means that both a transmitter and receiver is required. Since we have already assumed a receiving capability inherent in navigation by radio, this has added a transmitting requirement. "navigation information" is a direct output of already required navigation system operation, hence the phrase adds nothing to the sentence beyond better context. "aircraft and ground stations" denotes a specific environment in which the communication will occur. "over long distance" levies an operational requirement which will ultimately be reflected in transmitter power requirements and receiver sensitivity.

When one analyzes the process he recognizes that the significance of each phrase was very critically evaluated. One can quickly grasp the magnitude of a task which requires treatment of every sentence in a book-sized document in like manner. Further, the absurdity to which one is reduced is much like a psychiatrist performing an in-depth analysis of a person based on how he said "Good morning". No single sentence in a specification is intended to stand so alone that interpretation out of context will always be clear. This alternative reflects the age old error in logic - - mistaking precision for

correctness. The missing ingredient to this analysis is context. Once the context in which the sentence was written is established, the sentence can again be evaluated, but with a filter to screen out unwarranted nuances of meaning. Analysis of the above sentence from the context of its being an introductory statement would lead one to search for aspects of Mission Requirement in the statement. Thus the system is seen to have a requirement for long range air navigation using ground stations. While this approach lacks the precision of the previous approach and requires experienced judgement to apply context to the sentences, it is the best reflection of what the specification writer intended.

Use of the Procedure

A necessary first step in implementing the procedure is evaluation of the specification table of contents which outlines the hierarchy of the subject covered. Some specifications have a more detailed outline than others, and these are usually less likely to have amalgamated paragraphs of diverse subjects than the less structures specifications. Close evaluation of the specification hierarchy gives necessary insight into subject context, so vital in counting requirements in any given sentence. Once the hierarchy is known, a brief survey of the con-

tents should follow to gauge the number of graphs, tables, blank paragraphs and other features likely to make the specification atypical.

Classifying and counting requirements are two conceptually different functions which tend to merge when one becomes familiar with the process. Each sentence can be broken down into a number of candidate requirement statements without regard to type. This process leans heavily on the context of the statement for guidance. Once candidates are separated, the valid requirements are typed. Many requirements statements are not complicated and this process is not difficult in those cases. There are many complicating factors, however and these must be addressed.

Paragraphs which consist of a heading only, in order to reserve a space in the specification outline, are not counted as a requirement.

Sentences and paragraphs marked "to be determined" are not counted.

Items on the list of applicable documents found in the front of specifications are not counted, since they must be specifically referenced in the body of the specification. Their appearance here is only for reference.

Each reference to other system or Critical Item

Specifications is counted as one requirement.

Tables which array data in a matrix form shall have each cell count as one requirement.

Functional diagrams showing interfaces between components shall reflect each arrow which denotes interface as one requirement. Ancillary notes on the diagram are counted just as if they were text.

Graphs with points plotted on a two dimensional scale shall have each point count as a requirement. Where there is an outside boundary or performance envelope, it shall count as one additional requirement.

Revisions to specifications are made periodically. These revisions are not always reflected as totally revised documents but rather as revision notices attached to the original document. If such a revision notice is used to establish new requirement type numbers, care must be taken to insure that net changes in number are sought rather than the number of revisions. Some revisions change an already existing requirement which would total one revision but a net of zero new requirements.

Operational Characteristics are generally functional statements, while Design Requirements relate to attributes possessed by an item. Although the distinction is not always clear, anything expressed in terms of

quantities generally measures an attribute and is therefore a Design Requirement.

Relationships between Design Requirements are never Interface Requirements.

Wiring diagrams which include attributes such as voltage are Design Requirements.

Product requirements which relate to test conditions or environment are Design Requirements.

APPENDIX THREE

A PROPOSED FUTURE REQUIREMENT COUNTING STUDY

APPENDIX THREE

A PROPOSED FUTURE REQUIREMENT COUNTING STUDY

Introduction

If evaluation of the requirement counting procedure had resulted in clear and objective standards, then replication of the procedure would have been simple. The dissertation concludes, however, that some form of bounded subjectivity is the best one can ever do when counting requirements. A crucial question thus remains as to whether the subjective decision process can be sufficiently bounded to give usuable and repeatable results. The crux of this issue is not whether one unique person can replicate his own results, but rather if a group of qualified researchers can do it.

This appendix describes one way in which consensus among such researchers might be gained. The goal of the research is to produce replicable results in a specification requirements counting process. Since subjectivity is woven into fabric of the problem, more than a list of rules is anticipated as outcome. First, there must be such a list to bound subjectivity as much as can be done. Secondly, however, insights into classes of problems encountered is necessary.

Study Group Constitution

It is obvious that the study group members must be already familiar with the military research and development processes to be effective. The more current a member's experience, the more useful it will be.

The investigation must be rooted in good analysis procedure. The disciplined approach required for such a study is traditionally required of graduate students. The group is envisioned to contain three students. Although group consensus represents the optimum support for a resultant group finding, it is recognized that this does not happen for every point and thus a tie breaking number is selected. The specific operations of the group is not a necessary subject for extensive prior definition since the group's size is small enough to allow group procedures to conform to differences in member personalities. Agreement on the time frame, support functions such as typing, and conflict resolution procedures should be squared away as soon as possible.

Group Dynamics - - The Learning Process

Reading and discussing this dissertation and the included requirements taxonomy is the first step. This is primarily an individual effort with the supervising professor acting as coordinator. Use of the dissertation

gives every member a common base of departure in evaluating the taxonomy. Each member should independently write his questions and criticisms of the material and submit them to the supervising professor. Independently derived inputs might well overlap but it gives the best chance for a wide perspective. While consensus opinions derived from group processes are sought at the end of the research, they should be discouraged early. The supervising professor will sort the comments and questions and put together an aggregate agenda for the first group discussion. The first discussion group is aimed at the non-specific goal of merely understanding the requirement categories and how they relate. This might require more than one meeting, but the group should resist going on without completing it. One member should act as secretary and document unresolved issues and agreements alike. When the group thinks it understands the separate requirement types, it should propose an initial process for counting them.

Group Dynamics - - The Synthesis

Classically, thesis and antithesis meet and result in a synthesis. In this case, the study group has developed its own thesis from a critique of the dissertation. Antithesis is embodied in the confrontation of an

actual specification with the thesis. The synthesis should be a more usuable requirements counting procedure and possibly some enlightened comments on the process. The actual specification given should be carefully selected. It should reflect the common characteristics of current specifications. It is not prudent to start evaluation with the most atypical specification but rather the study should build slowly from the most common base to various types of atypical specification (too many graphs, lack of clear product hierarchy, etc.). The first evaluation of these specifications should again be individual effort. In effect, this makes three embryonic first syntheses instead of one. The first point of comparison would then be between each study member's raw total counts in each category. This is appropriate because the ultimate test of repeatability lies in the raw number counts.

This process will lead to new procedures and insights which should be separately recorded. One should resist trying to tie insights from each iteration together until later in the study in order to leave large latitude for developing threads of thought without imposing preconceived patterns on the data. The process should proceed through first synthesis to two more iterations

using different parts of the target specification in each case.

Study Results

At this point, the threads of insight about classes of problems and exceptions to procedures should be traced and major conclusions made. A final test of the procedures should be made by evaluating, once again, the original specification section which had been evaluated only that once. Enough time should have transpired by now to have negated any originally patterned thoughts. Analysis of the variances from the original data counts for each requirement category can be accomplished. The greatest change in numbers should reflect the greatest conceptual shift. This avenue should be explored and compared to the major insights derived independently. Convergence of one or more student's final count on another's original count might reflect the presence of a strong personality rather than a logical shift. The primary test will be to see if the spread of raw data counts in each original requirement category was reduced significantly in the final count between the researchers <u>and</u> if the reduced spread is explained by the changed procedures and insights. This last requirement is vital since any group of people

working together over a period of time on one subject will probably see their thoughts converge. Only those convergences that can be expressed in revised procedures and clear insights can validly be considered as affecting the general ability of the requirement counting process to be replicated.

APPENDIX FOUR

PROJECT SOURCE DATA

APPENDIX FOUR

PROJECT SOURCE DATA

Project A

Project A is a low frequency navigation system labeled the AN/ARN 131 Omega System. The specification used is model specification 33657-74-R-0673 dated 10 May 1974. It was revised on 30 July 1975.

Project B

Project B is a digital inertial measurement unit designated the AN/ARN 101(V). Its specification is CB 101-033-35351 dated 3 October 1975 and revised on 1 December 1976.

Project C

Project C is a two way radio operating in the 225 to 399.975 MegaHertz frequency range and it is designated the ARC 164(V). The specification is ENCA Exhibit 72-9 dated 28 November 1972 and revised 4 March 1974.

Project D

Project D is an interface electronics unit designed to interface with the LN-15 inertial measurement unit. Its specification is EC 229-10082-1 dated 22 December 1972 and revised 12 September 1974, 8 August, 1975

and 4 March 1977.

Project E

Project E is a terrain following radar unit data terminal. Its specification is EC 229-10059-1 dated 29 April 1974 and revised 24 September 1974, 8 August 1975, 24 September 1976 and 7 March 1977.

Project F

Project F is a defensive system electronics counter-measures receiver. Its specification is 00752-EC07878 139-0601 dated 5 June 1975 and revised 16 September 1975, 7 November 1975, 26 September 1976 and 1 March 1977.

Project G

Project G is an electronically steerable antenna system. Its original specification was ENADD Exhibit 76-21 dated 11 May 1977 and subsequently revised and superseded by specification 1708006 dated 5 December 1977 and itself revised on 2 January 1978.

APPENDIX FIVE

COMPUTER RUN WITH 23 RAW DATA POINTS

FILE WARD (CREATION DATE = 24 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

VARIABLE	MEAN	STANDARD DEV	CASES
MISREQ	8.8435	2.6710	23
OPCHAR	115.6522	86.8125	23
DERSS	316.5652	163.1538	23
INTERFAC	64.3043	31.3114	23
TIME	13.8435	13.6664	23

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

	MISREQ	OPCHAR	DERSS	INTERFAC
OPCHAR	-.02328			
DERSS	.06743	.00954		
INTERFAC	-.49910	.30396	.44441	
TIME	-.10008	-.17663	.33021	.39799

```
MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS                                   24 AUG 78      PAGE    5

FILE    WARD      (CREATION DATE =  24 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * M U L T I P L E     R E G R E S S I O N * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..     OPCHAR      OPERATIONAL CHARACTERISTICS

MEAN RESPONSE       115.65217       STD. DEV.       86.81248

VARIABLE(S) ENTERED ON STEP NUMBER   1..    TIME        TIME FROM SPEC START

MULTIPLE R              .17663         ANALYSIS OF VARIANCE      DF       SUM OF SQUARES         MEAN SQUARE            F      SIGNIFI
R SQUARE                .03120         REGRESSION                 1.          5877.55345          5877.55345         .67623    .42
ADJUSTED R SQUARE      -.01494         RESIDUAL                  21.        157681.66394          7508.65066
STD DEVIATION         86.65247         COEFF OF VARIABILITY      74.9 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------        ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE           B          STD ERROR B          F             BETA           VARIABLE      PARTIAL     TOLERANCE          F
                                              ------------   ----------                                                -----------
                                              SIGNIFICANCE   ELASTICITY                                                SIGNIFICANC

TIME          -1.1116331      1.3518085        .67622715      -.1766259
                                                    .420       -.12537
(CONSTANT)    130.15174       25.246801       26.577539
                                                    .000

ALL VARIABLES ARE IN THE EQUATION.


COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE          B           STD ERROR B           T              95.0 PCT CONFIDENCE INTERVAL

TIME          -1.1116331      1.3518085      -.82233032          -3.9228728     ,  1.6996866
CONSTANT      130.15174       25.246801      5.1553408           77.649804     ,  182.65367

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME          1.82739

              TIME
```

FILE WARD (CREATION DATE = 24 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. DERSS DESIGN REQMT=SPEC STANDARDS

MEAN RESPONSE 316.56522 STD. DEV. 163.15298

VARIABLE(S) ENTERED ON STEP NUMBER 1.. TIME TIME FROM SPEC START

MULTIPLE R	.33421	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.11170	REGRESSION	1.	65412.59087	65412.59087	2.64063	.12
ADJUSTED R SQUARE	.06940	RESIDUAL	21.	520203.06131	24771.57435		
STD DEVIATION	157.38988	COEFF OF VARIABILITY	49.7 PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
TIME	3.9899266	2.4553366	2.6406312 / .119	.3342138 / .16440
(CONSTANT)	264.52270	45.855184	33.277370 / .000	

---------- VARIABLES NOT IN THE EQUATION ------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
TIME	3.9899266	2.4553366	1.6250819	-1.1162254 , 9.0960785
CONSTANT	264.52270	45.855184	5.7686541	169.16162 , 359.88377

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME	6.02868
	TIME

```
MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS                              24 AUG 78     PAGE    9

FILE   WARD     (CREATION DATE =  24 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E    R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..     INTERFAC   INTERFACE REQMTS

MEAN RESPONSE        64.30435      STD. DEV.      31.31139

VARIABLE(S) ENTERED ON STEP NUMBER   1..   TIME       TIME FROM SPEC START

MULTIPLE R            .39799        ANALYSIS OF VARIANCE      DF       SUM OF SQUARES        MEAN SQUARE            F      SIGNIFI
R SQUARE              .15839        REGRESSION                 1.          3416.37385         3416.37385       3.95228    .06
ADJUSTED R SQUARE     .11832        RESIDUAL                  21.         18152.49652          864.40460
STD DEVIATION       29.40076        COEFF OF VARIABILITY      45.7 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------         ---------- VARIABLES NOT IN THE EQUATION ------

VARIABLE            B           STD ERROR B          F            BETA         VARIABLE      PARTIAL    TOLERANCE          F
                                                -------------  ----------                                             -----------
                                                 SIGNIFICANCE  ELASTICITY                                             SIGNIFICANC

TIME          .91183629        .45866288        3.9522847       .3979871
                                                     .060         .18496
(CONSTANT)   52.410831        8.5658442        37.437861
                                                     .000

ALL VARIABLES ARE IN THE EQUATION.


COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE           B           STD ERROR B          T             95.0 PCT CONFIDENCE INTERVAL

TIME          .91183629        .45866288       1.9880354        -.42083563E-01,  1.8656761
CONSTANT     52.410831        8.5658442        6.1185833         34.597183    ,  70.224479

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME          .21037
           TIME
```

FILE HARD (CREATION DATE = 24 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. MISREQ MISSION REQUIREMENTS

MEAN RESPONSE 8,84348 STD. DEV. 2,67103

VARIABLE(S) ENTERED ON STEP NUMBER 1.. INTERFAC INTERFACE REQMTS

MULTIPLE R	,49910	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	,24910	REGRESSION	1,	39,09722	39,09722	6,96629	.015
ADJUSTED R SQUARE	,21334	RESIDUAL	21,	117,85930	5,61235		
STD DEVIATION	2,36904	COEFF OF VARIABILITY	29,5 PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
INTERFAC	-,42575451E-01	,16130900E-01	6,9662865 ,015	-,4990951 -,34037
(CONSTANT)	10,781265	1,1409836	80,058702 0	

---------- VARIABLES NOT IN THE EQUATION ------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
DPCHAR	,15557	,98761	,49601448 ,489
DERSS	,37258	,88258	3,2239204 ,088

* *

VARIABLE(S) ENTERED ON STEP NUMBER 2.. DERSS DESIGN REQMT=SPEC STANDARDS

MULTIPLE R	,59442	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFIC
R SQUARE	,35334	REGRESSION	2,	55,45833	27,72916	5,46397	.013
ADJUSTED R SQUARE	,28867	RESIDUAL	20,	101,49819	5,07491		
STD DEVIATION	2,25276	COEFF OF VARIABILITY	28,0 PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
INTERFAC	-,56238592E-01	,17122981E-01	10,787336 ,004	-,6592626 -,44968
DERSS	,59003374E-02	,32861296E-02	3,2239204 ,088	,3684872 ,23222
(CONSTANT)	9,7920226	1,7235693	64,045361	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
DPCHAR	,22919	,88797	1,0533573 ,318

FILE WARD (CREATION DATE = 24 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * M U L T I P L E   R E G R E S S I O N * * * * * * * * * *

DEPENDENT VARIABLE.. MISREQ MISSION REQUIREMENTS

VARIABLE(S) ENTERED ON STEP NUMBER 3.. OPCHAR OPERATIONAL CHARACTERISTICS

MULTIPLE R	.62234	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.38730	REGRESSION	3.	60.78980	20.26327	4.00349	.023
ADJUSTED R SQUARE	.29056	RESIDUAL	19.	96.16673	5.06141		
STD DEVIATION	2.24976	COEFF OF VARIABILITY	28.0 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
INTERFAC	-.62469903E-01	.18145963E-01	11.851727 / .003	-.7323898 / -.49942
DERSS	.64012552E-02	.33178492E-02	3.7223481 / .069	.3910045 / .25193
OPCHAR	.60736766E-02	.59178479E-02	1.0533573 / .318	.1955847 / .08733
(CONSTANT)	9.3317160	1.3016481	51.396775 / 0	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
INTERFAC	-.62469903E-01	.18145963E-01	-3.4426337	-.10044984 ,	-.24489967E-01
DERSS	.64012552E-02	.33178492E-02	1.9293388	-.54308311E-03,	.13345593E-01
OPCHAR	.60736766E-02	.59178479E-02	1.0263320	-.63125215E-02,	.18459875E-01
CONSTANT	9.3317160	1.3016481	7.1691544	6.6073353 ,	12.056097

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

OPCHAR	.00004		
DERSS	.00000	.00001	
INTERFAC	-.00004	-.00003	.00033

APPENDIX SIX

COMPUTER RUN WITH 23 TRANSFORMED DATA POINTS

APPENDIX SIX

COMPUTER RUN WITH 23 TRANSFORMED DATA POINTS

MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS 28 AUG 78 PAGE 2

FILE WARD (CREATION DATE = 28 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

VARIABLE	MEAN	STANDARD DEV	CASES
MISREQ	104.0870	10.0087	23
OPCHAR	128.3478	42.5901	23
DERSS	140.0435	68.2605	23
INTERFAC	128.2174	33.0178	23
TIME	13.0435	13.6664	23

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

OPCHAR	.78996			
DERSS	.33339	.36964		
INTERFAC	.50680	.85118	.58529	
TIME	.62738	.79290	.24143	.65374
	MISREQ	OPCHAR	DERSS	INTERFAC

```
MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS                                    28 AUG 78      PAGE    3

FILE   WARU     (CREATION DATE =  28 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..    MISREQ     MISSION REQUIREMENTS

MEAN RESPONSE      104.08696      STD. DEV.      10.00869

VARIABLE(S) ENTERED ON STEP NUMBER   1..   TIME       TIME FROM SPEC START

MULTIPLE R            .62738        ANALYSIS OF VARIANCE      DF       SUM OF SQUARES          MEAN SQUARE             F      SIGNIFI
R SQUARE              .39360        REGRESSION                1.           867.42599            867.42599        13.63061    .001
ADJUSTED R SQUARE     .36474        RESIDUAL                 21.          1336.40010             63.63810
STD DEVIATION        7.97735        COEFF OF VARIABILITY      7.7 PCT

-------------------- VARIABLES IN THE EQUATION --------------------          -------- VARIABLES NOT IN THE EQUATION --------

VARIABLE           B          STD ERROR B          F             BETA           VARIABLE      PARTIAL     TOLERANCE        F
                                              ------------   -----------                                              -----------
                                              SIGNIFICANCE   ELASTICITY                                               SIGNIFICANC

TIME          .45946289       .12444941        13.630608     .6273755
                                                    .001       .05758
(CONSTANT)  98.093962        2.3241826       1781.3287
                                                       0

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE           B          STD ERROR B          T               95.0 PCT CONFIDENCE INTERVAL

TIME          .45946289       .12444941        3.6919653          .20065618    ,  .71826960
CONSTANT    98.093962        2.3241826        42.205790          93.260560     ,  102.92736

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME            .01549

             TIME
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MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS                                  28 AUG 78     PAGE    5
FILE    WARD     (CREATION DATE = 28 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..    OPCHAR       OPERATIONAL CHARACTERISTICS

MEAN RESPONSE      128.34783      STD. DEV.      42.55009

VARIABLE(S) ENTERED ON STEP NUMBER   1..   TIME        TIME FROM SPEC START

MULTIPLE R              .79290        ANALYSIS OF VARIANCE    DF     SUM OF SQUARES      MEAN SQUARE           F      SIGNIFI
R SQUARE                .62869        REGRESSION               1.      25041.31618      25041.31618       35.55586    .0
ADJUSTED R SQUARE       .61100        RESIDUAL                21.      14789.90121        704.28101
STD DEVIATION         26.53829        COEFF OF VARIABILITY    20.7 PCT


----------------------- VARIABLES IN THE EQUATION -----------------------      ------------ VARIABLES NOT IN THE EQUATION ------

VARIABLE           B          STD ERROR B          F           BETA          VARIABLE      PARTIAL    TOLERANCE          F
                                              ------------  ------------                                             ------------
                                              SIGNIFICANCE  ELASTICITY                                               SIGNIFICANC

TIME          2.4686687       .41400655       35.595859      .7928970
                                                   .000       .25088
(CONSTANT)   96.147800       7.7318715       154.63559
                                                     0

ALL VARIABLES ARE IN THE EQUATION.


COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE          B           STD ERROR B          T            95.0 PCT CONFIDENCE INTERVAL

TIME          2.4686687       .41400655       5.9628734       1.6076949    ,  3.3296424
CONSTANT     96.147800       7.7318715       12.435256       80.068493    ,  112.22711

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME          .17140
                TIME
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FILE WARD (CREATION DATE = 28 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. DENSS DESIGN REQMT+SPEC STANDARDS

MEAN RESPONSE 140.04348 STD. DEV. 68.26052

VARIABLE(S) ENTERED ON STEP NUMBER 1.. TIME TIME FROM SPEC START

MULTIPLE R	.24143	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.05829	REGRESSION	1.	5975.14089	5975.14089	1.29983	.27
ADJUSTED R SQUARE	.01345	RESIDUAL	21.	96533.81563	4596.84846		
STD DEVIATION	67.80006	COEFF OF VARIABILITY	48.4 PCT				

------------------------ VARIABLES IN THE EQUATION ------------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
TIME	1.2058917	1.0577044	1.2998342 .267	.2414311 .11232
(CONSTANT)	124.31446	19.753394	39.605894 .000	

------------ VARIABLES NOT IN THE EQUATION ------------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
TIME	1.2058917	1.0577044	1.1401027	-.99372506 , 3.4055084
CONSTANT	124.31446	19.753394	6.2933213	83.235024 , 165.39389

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME	1.11874
	TIME

WAR (CREATION DATE = 28 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. INTERFAC INTERFACE REQMTS

MEAN RESPONSE 128.21739 STD. DEV. 33.01784

VARIABLE(S) ENTERED ON STEP NUMBER 1.. TIME TIME FROM SPEC START

MULTIPLE R	.65374	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.42737	REGRESSION	1.	10260.11535	10250.11535	15.67319	.001
ADJUSTED R SQUARE	.40011	RESIDUAL	21.	13733.79770	653.99037		
STD DEVIATION	25.57324	COEFF OF VARIABILITY	19.9 PCT				

------------------ VARIABLES IN THE EQUATION ------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
TIME	1.5794235	.39895132	15.673190 / .001	.6537389 / .16067
(CONSTANT)	107.61621	7.4507041	208.62233 / 0	

------------------ VARIABLES NOT IN THE EQUATION ------------------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
TIME	1.5794235	.39895132	3.9589380	.74975884 , 2.4090882
CONSTANT	107.61621	7.4507041	14.443765	92.121627 , 123.11080

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME	.15916
	TIME

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE..   MISREQ   MISSION REQUIREMENTS

MEAN RESPONSE   104.08696   STD. DEV.   10.00869

VARIABLE(S) ENTERED ON STEP NUMBER 1..   OPCHAR   OPERATIONAL CHARACTERISTICS

MULTIPLE R	.78996	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.62404	REGRESSION	1.	1375.28576	1375128576	34.85769	0
ADJUSTED R SQUARE	.60614	RESIDUAL	21.	828.54013	39145430		
STD DEVIATION	6.28127	COEFF OF VARIABILITY	6.0 PCT				

------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
OPCHAR	.1858166/	.31472800E-01	34.857689 .000	.7899649 .22911
(CONSTANT)	80.237790	4.2464910	357.02407 0	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
DERSS	107269	.86337	.10607698 .748
INTERFAC	-.151456	.27550	7.2823176 .014

* *

VARIABLE(S) ENTERED ON STEP NUMBER 2..   INTERFAC   INTERFACE REQMTS

MULTIPLE R	.85064	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.72359	REGRESSION	2.	1594.65716	797.32858	26.17759	0
ADJUSTED R SQUARE	.69594	RESIDUAL	20.	609.16892	30.45845		
STD DEVIATION	5.51892	COEFF OF VARIABILITY	5.3 PCT				

------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
OPCHAR	.30616519	.52684670E-01	33.770935 .000	1.3016042 .37753
INTERFAC	-.19220798	.67894725E-01	7.2023176 .014	-.6010956 -.22445
(CONSTANT)	88.153809	4.7562118	343.52614	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
DERSS	150216	.59747	6.4068306 .020

FILE WARD (CREATION DATE = 28 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. MISREQ MISSION REQUIREMENTS

VARIABLE(S) ENTERED ON STEP NUMBER 3.. DERSS DESIGN REQMT*SPEC STANDARDS

MULTIPLE R	.89067	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.79329	REGRESSION	3.	1748.27105	582.75702	24.30526	0
ADJUSTED R SQUARE	.76065	RESIDUAL	19.	455.55503	23.97658		
STD DEVIATION	4.89659	COEFF OF VARIABILITY	4.7 PCT				

------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
OPCHAR	.34365153	.49033818E-01	49.119505	1.4609704
			.000	.42375
INTERFAC	-.28392844	.72413009E-01	15.373920	-.9366563
			.001	-.34975
DERSS	.50081566E-01	.19785921E-01	6.4069306	.3415625
			.020	.06738
(CONSTANT)	89.370997	4.2471992	442.77995	
			0	

-----*--- VARIABLES NOT IN THE EQUATION ------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
OPCHAR	.34365153	.49033818E-01	7.0084596	.24102257 ,	.44628049
INTERFAC	-.28392844	.72413009E-01	-3.9209590	-.43549061 ,	-.13236627
DERSS	.50081566E-01	.19785921E-01	2.5311718	.86691566E-02,	.91493975E-01
CONSTANT	89.370997	4.2471992	21.042137	80.481507 ,	98.260488

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

OPCHAR	.00240		
DERSS	.00029	.00039	
INTERFAC	-.00299	-.00000	.00524

APPENDIX SEVEN

COMPUTER RUN WITH 64 TRANSFORMED DATA POINTS

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

VARIABLE	MEAN	STANDARD DEV	CASES
MISREQ	1.8225	.8760	64
OPCHAR	1.1680	.3052	64
DERSS	1.2516	.5044	64
INTERFAC	1.1691	.2550	64
TIME	14.1406	9.6377	64

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

	MISREQ	OPCHAR	DERSS	INTERFAC
OPCHAR	.79928			
DERSS	.48676	.45452		
INTERFAC	.54741	.87447	.64128	
TIME	.52805	.66998	.16147	.52342

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. MISREQ MISSION REQUIREMENTS

MEAN RESPONSE 1.02250 STD. DEV. .07603

VARIABLE(S) ENTERED ON STEP NUMBER 1.. TIME TIME FROM SPEC START

MULTIPLE R	.52805	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.27884	REGRESSION	1.	.10155	.10155	23.97250	0
ADJUSTED R SQUARE	.26721	RESIDUAL	62.	.26265	.00424		
STD DEVIATION	.06509	COEFF OF VARIABILITY	6.4 PCT				

-------------------- VARIABLES IN THE EQUATION ---------------------- ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
TIME	.41658589E-02	.85083998E-03	23.972501 / .000	.5280522 / .05761
(CONSTANT)	.96359215	.14523981E-01	4401.6464 / 0	

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
TIME	.41658589E-02	.85083998E-03	4.8961721	.24650541E-02,	.58666638E-02
CONSTANT	.96359215	.14523981E-01	66.344985	.93455913 ,	.99262518

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME	.00000
	TIME

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MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS

FILE    HARD     (CREATION DATE =  31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E    R E G R E S S I O N  * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..    OPCHAR     OPERATIONAL CHARACTERISTICS

MEAN RESPONSE        1.16797      STD. DEV.        .30521

VARIABLE(S) ENTERED ON STEP NUMBER   1..   TIME       TIME FROM SPEC START

MULTIPLE R            .66998       ANALYSIS OF VARIANCE     DF      SUM OF SQUARES       MEAN SQUARE          F      SIGNIFI-
R SQUARE              .44888       REGRESSION               1.            2.63431           2.63431      50.49885      0
ADJUSTED R SQUARE     .43999       RESIDUAL                62.            3.23433            .05217
STD DEVIATION         .22840       COEFF OF VARIABILITY    19.6 PCT

-------------------- VARIABLES IN THE EQUATION ----------------------    ---------- VARIABLES NOT IN THE EQUATION ------

VARIABLE            B             STD ERROR B          F            BETA        VARIABLE      PARTIAL    TOLERANCE        F
                                                  ------------  ----------                                           -----------
                                                  SIGNIFICANCE  ELASTICITY                                           SIGNIFICANC

TIME         .212173<b>47E-01    .298575<b>24E-02    50.498849      .6699846
                                                     .000          .25688
(CONSTANT)   .86799220        .509672<b>94E-01    290.00031
                                                     0

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE        B              STD ERROR B          T             95.0 PCT CONFIDENCE INTERVAL

TIME         .21217347E-01    .29857524E-02    7.1061980       .15248913E-01,  .27185781E-01
CONSTANT     .86799220        .50967294E-01   17.029395        .76606803    ,  .96982437

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME          .00001

              TIME
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MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS                                        31 AUG 78     PAGE    7

FILE   HAND      (CREATION DATE =  31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..    DERSS      DESIGN REQMT*SPEC STANDARDS

MEAN RESPONSE          1.25156      STD. DEV.         .58448

VARIABLE(S) ENTERED ON STEP NUMBER   1..   TIME       TIME FROM SPEC START

MULTIPLE R              .16147        ANALYSIS OF VARIANCE     DF       SUM OF SQUARES        MEAN SQUARE            F       SIGNIFI
R SQUARE                .02607        REGRESSION                1.               .56100             .56100         1.65986    .20
ADJUSTED R SQUARE       .01037        RESIDUAL                 62.             20.95484             .33798
STD DEVIATION           .58136        COEFF OF VARIABILITY     46.5 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION ------

VARIABLE          B           STD ERROR B          F          BETA            VARIABLE      PARTIAL     TOLERANCE        F
                                              ------------  -----------                                              -----------
                                              SIGNIFICANCE  ELASTICITY                                               SIGNIFICANC

TIME          .979127745E-02   .759983333E-02   1.6598557     .1614739
                                                    .202       .11063
(CONSTANT)    1.1131878        .12973043       73.619136
                                                    .000

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE         B           STD ERROR B          T              95.0 PCT CONFIDENCE INTERVAL

TIME        .979127745E-02   .759983333E-02   1.2883539        -.540857580E-02,  .249831250E-01
CONSTANT    1.1131878        .12973043        8.9801594         .85370033     ,  1.3724352

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFILIENTS.

TIME          .00006

              TIME
```

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. INTERFAC INTERFACE REQMTS

MEAN RESPONSE 1.16906 STD. DEV. .25584

VARIABLE(S) ENTERED ON STEP NUMBER 1.. TIME TIME FROM SPEC START

MULTIPLE R	.52342	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.27396	REGRESSION	1.	1.12976	1.12976	23.39532	0
ADJUSTED R SQUARE	.26225	RESIDUAL	62.	2.99398	.04829		
STD DEVIATION	.21975	COEFF OF VARIABILITY	18.8 PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
TIME	.13894759E-01	.28726759E-02	23.395323 .000	.5234166 .16807
(CONSTANT)	.97258193	.49037044E-01	393.37235 0	

---------- VARIABLES NOT IN THE EQUATION ------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
TIME	.13894759E-01	.28726758E-02	4.8368712	.81523633E-02, .19637154E-01
CONSTANT	.97258193	.49037044E-01	19.833617	.87455827 , 1.0706056

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME	.00001
	TIME

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DEPENDENT VARIABLE.. MISREQ MISSION REQUIREMENTS

MEAN RESPONSE 1.02250 STD. DEV. .07683

VARIABLE(S) ENTERED ON STEP NUMBER 1.. OPCHAR OPERATIONAL CHARACTERISTICS

MULTIPLE R	.79928	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.63885	REGRESSION	1.	.23267	.23267	109.67302	0
ADJUSTED R SQUARE	.63303	RESIDUAL	62.	.13153	.00212		
STD DEVIATION	.04606	COEFF OF VARIABILITY	4.5 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
OPCHAR	.19911356	.19812943E-01	109.67302 / .000	.7992809 / .22744
(CONSTANT)	.78994158	.22940740E-01	1185.7808 / .000	

---------- VARIABLES NOT IN THE EQUATION ------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
DENSS	.00122	.79341	.40502072 / .527
INTERFAC	-.51983	.23531	22.587581 / .000

* *

VARIABLE(S) ENTERED ON STEP NUMBER 2.. INTERFAC INTERFACE REQMTS

MULTIPLE R	.85816	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFIC
R SQUARE	.73644	REGRESSION	2.	.26821	.13411	85.22419	0
ADJUSTED R SQUARE	.72780	RESIDUAL	61.	.09599	.00157		
STD DEVIATION	.03967	COEFF OF VARIABILITY	3.9 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
OPCHAR	.33940651	.33756491E-01	101.09408 / 0	1.3624444 / .38769
INTERFAC	-.19138809	.40269853E-01	22.587581 / .000	-.6440073 / -.21882
(CONSTANT)	.84982844	.23433707E-01	1315.1658	

---------- VARIABLES NOT IN THE EQUATION --------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
DENSS	.53187	.54078	23.570027 / .000

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FILE   WARD     (CREATION DATE =  31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..      MISREQ      MISSION REQUIREMENTS

VARIABLE(S) ENTERED ON STEP NUMBER   3..   DERSS      DESIGN REQMT*SPEC STANDARDS

MULTIPLE R             .90043       ANALYSIS OF VARIANCE       DF       SUM OF SQUARES        MEAN SQUARE           F       SIGNIFI
R SQUARE               .81078       REGRESSION                  3.               .29528            .09843       85.69480      0
ADJUSTED R SQUARE      .80131       RESIDUAL                   60.               .06892            .00115
STD DEVIATION          .03389       COEFF OF VARIABILITY      3.3 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------        ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE            B           STD ERROR B           F             BETA          VARIABLE      PARTIAL     TOLERANCE        F
                                                ------------   -----------                                                -----------
                                                SIGNIFICANCE   ELASTICITY                                                SIGNIFICANC

OPCHAR         .38111419      .30892436E-01     160.39674      1.5298672
                                                        0        .43533
INTERFAC      -.30555444      .41673521E-01     53.759694     -1.0281689
                                                     .000       -.34935
DERSS          .48236354E-01  .99356076E-02     23.570027       .3707522
                                                     .000        .05904
(CONSTANT)     .07421196      .20641126E-01     1793.7699
                                                     .000

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE            B          STD ERROR B          T              95.0 PCT CONFIDENCE INTERVAL

OPCHAR         .38111419      .30892436E-01   12.664784          .32092036     ,  .44130803
INTERFAC      -.30555444      .41673521E-01   -7.3321003        -.38891389     , -.22219498
DERSS          .48236354E-01  .99356076E-02    4.8548973         .28362179E-01,  .68110528E-01
CONSTANT       .07421196      .20641126E-01   42.352921          .83292356     ,  .91550035

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

OPCHAR         .00091
DERSS          .00009      .00010
INTERFAC      -.00107     -.00023     .00174
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OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL
1.	1.000000	.9980081	.1991935E-02
2.	1.000000	.9980081	.1991935E-02
3.	1.000000	.9980081	.1991935E-02
4.	1.000000	.9980081	.1991935E-02
5.	1.000000	.9980081	.1991935E-02
6.	1.000000	.9980081	.1991935E-02
7.	1.000000	.9980081	.1991935E-02
8.	1.000000	1.005163	-.5162597E-02
9.	1.000000	.9980081	.1991935E-02
10.	1.000000	.9980081	.1991935E-02
11.	1.000000	.9980081	.1991935E-02
12.	1.000000	.9980081	.1991935E-02
13.	1.000000	.9980081	.1991935E-02
14.	1.000000	.9980081	.1991935E-02
15.	1.000000	1.013245	-.1324477E-01
16.	1.000000	1.003169	-.3169039E-02
17.	1.000000	.9980081	.1991935E-02
18.	1.000000	.9980081	.1991935E-02
19.	1.000000	.9980081	.1991935E-02
20.	1.000000	.9980081	.1991935E-02
21.	1.000000	.9980081	.1991935E-02
22.	1.000000	.9860664	.1393365E-01
23.	1.000000	1.013245	-.1324477E-01
24.	1.000000	1.003169	-.3169039E-02
25.	1.000000	.9980081	.1991935E-02
26.	1.000000	.9980081	.1991935E-02
27.	1.000000	.9980081	.1991935E-02
28.	1.000000	.9980081	.1991935E-02
29.	1.170000	1.163752	.6248077E-02
30.	1.000000	1.013245	-.1324477E-01
31.	1.000000	1.003169	-.3169039E-02
32.	1.000000	.9980081	.1991935E-02
33.	1.000000	.9980081	.1991935E-02
34.	1.000000	.9980081	.1991935E-02
35.	1.110000	.9891675	.1208325
36.	1.000000	.9980081	.1991935E-02
37.	1.000000	.9980081	.1991935E-02
38.	1.000000	1.003169	-.3169039E-02
39.	1.000000	1.013245	-.1324477E-01
40.	1.170000	1.163752	.6248077E-02
41.	1.000000	.9525921	.4740795E-01
42.	1.000000	1.005098	-.5098493E-02
43.	1.000000	1.003169	-.3169039E-02
44.	1.000000	1.013245	-.1324477E-01
45.	1.000000	.9980081	.1991935E-02
46.	1.000000	1.040475	-.4047537E-01
47.	1.000000	1.013245	-.1324477E-01
48.	1.000000	.9980081	.1991935E-02
49.	1.000000	1.015441	-.1544133E-01
50.	1.000000	1.040475	-.4047537E-01
51.	1.000000	.9980081	.1991935E-02

-280 0.0

R

MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* MULTIPLE REGRESSION *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0	
53.	1.000000	1.040475	-.4047537E-01		I	
54.	1.000000	1.015441	-.1544133E-01		I	
55.	1.000000	1.084158	-.8415830E-01	R	I	
56.	1.000000	.9908142	.9185755E-02		I	
57.	1.000000	1.040475	-.4047537E-01		I	
58.	1.000000	1.014129	-.1412906E-01		I	
59.	1.000000	.9908142	.9185755E-02		I	
60.	1.330000	1.210279	.1197218		I	R
61.	1.000000	1.014129	-.1412906E-01		I	
62.	1.000000	1.033330	-.3332979E-01		I	
63.	1.330000	1.210279	.1197218		I	R
64.	1.330000	1.407322	-.7732227E-01	R	I	

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 64.
NUMBER OF 2 S.D. OUTLIERS 5. OR 7.81 PERCENT OF THE TOTAL

VON NEUMANN RATIO 2.27141 DURBIN-WATSON TEST 2.23592

NUMBER OF POSITIVE RESIDUALS 40.
NUMBER OF NEGATIVE RESIDUALS 24.
NUMBER OF RUNS OF SIGNS 24.

EXPECTED NUMBER OF RUNS OF SIGNS 31.
EXPECTED S.D. OF RUN DISTRIBUTION 3.71612
UNIT NORMAL DEVIATE-
Z=(EXPECTED-OBSERVED)/S.D. -1.74914
PROBABILITY OF OBTAINING .GE. ABS(Z) .08013

DEPENDENT VARIABLE..   OPCHAR   OPERATIONAL CHARACTERISTICS

MEAN RESPONSE   1.16797   STD. DEV.   .30521

VARIABLE(S) ENTERED ON STEP NUMBER 1..   INTERFAC   INTERFACE REQMTS

MULTIPLE R	.87447	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.76469	REGRESSION	1.	4.48771	4.48771	201.48607	0
ADJUSTED R SQUARE	.76090	RESIDUAL	62.	1.38093	.02227		
STD DEVIATION	.14924	COEFF OF VARIABILITY	12.8 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
INTERFAC	1.0431972	.73492652E-01	201.48607 / .000	.8744675 / 1.04417
(CONSTANT)	-.51594031E-01	.87919473E-01	.34437274 / .559	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
MISREQ	.78973	.70035	101.09408 / 0
DERSS	-.28548	.58876	5.4126261 / .023

* *

VARIABLE(S) ENTERED ON STEP NUMBER 2..   MISREQ   MISSION REQUIREMENTS

MULTIPLE R	.95470	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.91145	REGRESSION	2.	5.34896	2.67448	313.93172	0
ADJUSTED R SQUARE	.90855	RESIDUAL	61.	.51968	.00852		
STD DEVIATION	.09230	COEFF OF VARIABILITY	7.9 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
INTERFAC	.74426541	.54312485E-01	187.78302 / 0	.6238858 / .74496
MISREQ	1.8375468	.18275764	101.09408 / 0	.4577621 / 1.60868
(CONSTANT)	-1.5810156	.16153875	95.789716	

---------- VARIABLES NOT IN THE EQUATION ------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
DERSS	-.57927	.58433	30.380189 / .000

AD-A107 875 AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH F/G 5/1
A STUDY OF RESEARCH AND DEVELOPMENT CONTRACT REQUIREMENTS AND T--ETC(U)
MAY 79 R G BLACKLEDGE
UNCLASSIFIED AFIT-CI-79-214D NL

3 OF 4
AD A
107875

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FILE    WARD      (CREATION DATE =  31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * *   M U L T I P L E   R E G R E S S I O N   * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..     OPCHAR      OPERATIONAL CHARACTERISTICS

VARIABLE(S) ENTERED ON STEP NUMBER   3..    DERSS       DESIGN REQMT*SPEC STANDARDS

MULTIPLE R            .97013        ANALYSIS OF VARIANCE      DF       SUM OF SQUARES        MEAN SQUARE           F      SIGNIFI
R SQUARE              .94116        REGRESSION                 3.            5.52334            1.84111       319.91529      0
ADJUSTED R SQUARE     .93822        RESIDUAL                  60.             .34530             .00575
STD DEVIATION         .07586        COEFF OF VARIABILITY       6.5 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION ------

VARIABLE           B            STD ERROR B           F           BETA           VARIABLE      PARTIAL     TOLERANCE        F
                                                 ------------  ----------                                              -----------
                                                 SIGNIFICANCE  ELASTICITY                                              SIGNIFICANC

INTERFAC       .90506076       .53347852E-01     207.82841      .7586736
                                                         0        .90591
MISREQ        1.9095685        .15077783         160.39674      .4757038
                                                      .000       1.67173
DERSS         -.11777093       .21395155E-01      30.300189     -.2255011
                                                      .000       -.12620
(CONSTANT)   -1.6952400        .13438101         159.14264
                                                         0

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE          B            STD ERROR B          T              95.0 PCT CONFIDENCE INTERVAL

INTERFAC      .90506076      .53347852E-01  16.965271        .79834913    ,  1.0117724
MISREQ       1.9095685       .15077783      12.664704       1.6079600     ,  2.2111691
DERSS        -.11777093      .21395155E-01  -5.5045608      -.16056761    , -.74974240E-01
CONSTANT    -1.6952400       .13438101     -12.615175      -1.9640420     , -1.4264379

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

MISREQ        .02273
DERSS        -.00028     .00046
INTERFAC     -.00329    -.00062     .00285
```

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0
1.	1.000000	1.001618	-.1618373E-02		.I
2.	1.000000	1.001618	-.1618373E-02		.I
3.	1.000000	1.001618	-.1618373E-02		.I
4.	1.000000	1.001618	-.1618373E-02		.I
5.	1.000000	1.001618	-.1618373E-02		.I
6.	1.000000	1.001618	-.1618373E-02		.I
7.	1.000000	1.001618	-.1618373E-02		.I
8.	1.050000	1.038627	.1137255E-01		I .
9.	1.000000	1.001618	-.1618373E-02		.I
10.	1.000000	1.001618	-.1618373E-02		.I
11.	1.000000	1.001618	-.1618373E-02		.I
12.	1.000000	1.001618	-.1618373E-02		.I
13.	1.000000	1.001618	-.1618373E-02		.I
14.	1.000000	1.001618	-.1618373E-02		.I
15.	1.240000	1.235450	.4550097E-02		I.
16.	1.030000	1.021704	.8296060E-02		I .
17.	1.000000	1.001618	-.1618373E-02		.I
18.	1.000000	1.001618	-.1618373E-02		.I
19.	1.000000	1.001618	-.1618373E-02		.I
20.	1.000000	1.001618	-.1618373E-02		.I
21.	1.000000	1.001618	-.1618373E-02		.I
22.	1.140000	1.210347	-.7034694E-01		. I
23.	1.240000	1.235450	.4550097E-02		I.
24.	1.030000	1.021704	.8296060E-02		I .
25.	1.000000	1.001618	-.1618373E-02		.I
26.	1.000000	1.001618	-.1618373E-02		.I
27.	1.000000	1.001618	-.1618373E-02		.I
28.	1.000000	1.001618	-.1618373E-02		.I
29.	1.570000	1.560109	.9891475E-02		I .
30.	1.240000	1.235450	.4550097E-02		I.
31.	1.030000	1.021704	.8296060E-02		I .
32.	1.000000	1.001618	-.1618373E-02		.I
33.	1.000000	1.001618	-.1618373E-02		.I
34.	1.000000	1.001618	-.1618373E-02		.I
35.	1.230000	1.514068	-.2840676	R	I
36.	1.000000	1.001618	-.1618373E-02		.I
37.	1.000000	1.001618	-.1618373E-02		.I
38.	1.030000	1.021704	.8296060E-02		I .
39.	1.240000	1.235450	.4550097E-02		I.
40.	1.570000	1.560109	.9891475E-02		I .
41.	1.410000	1.618060	-.2080599	R	I
42.	1.030000	1.016993	.1300694E-01		I .
43.	1.030000	1.021704	.8296060E-02		I .
44.	1.240000	1.235450	.4550097E-02		I.
45.	1.000000	1.001618	-.1618373E-02		.I
46.	1.130000	1.026850	.1031496		I .
47.	1.240000	1.235450	.4550097E-02		I.
48.	1.000000	1.001618	-.1618373E-02		.I
49.	1.450000	1.470024	-.2002357E-01		. I
50.	1.130000	1.026850	.1031496		I .
51.	1.000000	1.001618	-.1618373E-02		.I

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0	
53.	1.130000	1.026050	.1031496		I	
54.	1.450000	1.470024	-.2002357E-01		I	
55.	1.970000	1.864040	.1059605		I	
56.	1.190000	1.230919	-.4891852E-01		I	
57.	1.130000	1.026050	.1031496		I	
58.	1.190000	1.180404	.9595076E-02		I	
59.	1.190000	1.230919	-.4891852E-01		I	
60.	1.930000	2.058397	-.1283968		I	
61.	1.190000	1.180404	.9595076E-02		I	
62.	1.210000	1.147364	.6263625E-01		I	
63.	1.930000	2.058397	-.1283968		I	
64.	2.750000	2.408708	.3412915		I	R

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 64.
NUMBER OF 2 S.D. OUTLIERS 3. OR 4.69 PERCENT OF THE TOTAL

VON NEUMANN RATIO 2.10512 DURBIN-WATSON TEST 2.07223

NUMBER OF POSITIVE RESIDUALS 24.
NUMBER OF NEGATIVE RESIDUALS 40.
NUMBER OF RUNS OF SIGNS 26.

EXPECTED NUMBER OF RUNS OF SIGNS 31.
EXPECTED S.D. OF RUN DISTRIBUTION 3.71612
UNIT NORMAL DEVIATE-
Z=(EXPECTED-OBSERVED)/S.D. -1.21094
PROBABILITY OF OBTAINING .GE. ABS(Z) .11296

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* * * * * * * * * * * * * * * * * * * * * * * M U L T I P L E   R E G R E S S I O N * * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..    DLRSS      DESIGN REQMTS-SPEC STANDARDS

MEAN RESPONSE         1.25156      STD. DEV.        .58440

VARIABLE(S) ENTERED ON STEP NUMBER   1..    INTERFAC    INTERFACE REQMTS

MULTIPLE R             .64128        ANALYSIS OF VARIANCE    DF       SUM OF SQUARES       MEAN SQUARE          F      SIGNIFI
R SQUARE               .41124        REGRESSION               1.            8.84816           8.84816       43.30598       0
ADJUSTED R SQUARE      .40174        RESIDUAL                62.           12.66760            .20432
STD DEVIATION          .45201        COEFF OF VARIABILITY    36.1 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE           B          STD ERROR B          F            BETA          VARIABLE      PARTIAL     TOLERANCE          F
                                               ------------  ----------                                              -----------
                                               SIGNIFICANCE  ELASTICITY                                              SIGNIFICANC

INTERFAC      1.4640082       .22259861       43.305978       .6412796        MISREQ        .00678       .70035     .46202768
                                                .000          1.36825                                                    .499
(CONSTANT)   -.46088986       .26628579       2.9957000                       OPCHAR       -.28548       .23531     5.4126261
                                                .088                                                                     .023

* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

VARIABLE(S) ENTERED ON STEP NUMBER   2..    OPCHAR      OPERATIONAL CHARACTERISTICS

MULTIPLE R             .67766        ANALYSIS OF VARIANCE    DF       SUM OF SQUARES       MEAN SQUARE          F      SIGNIFI
R SQUARE               .45922        REGRESSION               2.            9.88058           4.94029       25.90038       0
ADJUSTED R SQUARE      .44149        RESIDUAL                61.           11.63526            .19074
STD DEVIATION          .43674        COEFF OF VARIABILITY    34.9 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE           B          STD ERROR B          F            BETA          VARIABLE      PARTIAL     TOLERANCE          F
                                               ------------  ----------                                              -----------
                                               SIGNIFICANCE  ELASTICITY                                              SIGNIFICANC

INTERFAC      2.3668113       .44336392       28.497089       1.0361603       MISREQ        .53107       .26356     23.570027
                                                .000          2.21080                                                    .000
OPCHAR       -.86465252       .37165296       5.4126261      -.4515762
                                                .023          -.80690
(CONSTANT)   -.50550077       .25800095       3.8380491
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FILE HARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. DERSS DESIGN REQMT+SPEC STANDARDS

VARIABLE(S) ENTERED ON STEP NUMBER 3.. MISREQ MISSION REQUIREMENTS

		ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
MULTIPLE R	.78214	REGRESSION	3.	13.16218	4.38739	31.51236	0
R SQUARE	.61174	RESIDUAL	60.	8.35366	.13923		
ADJUSTED R SQUARE	.59233	COEFF OF VARIABILITY	29.8 PCT				
STD DEVIATION	.37313						

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
INTERFAC	3.4858626	.44341848	61.882868 / .000	1.5260786 / 3.25608
OPCHAR	-2.8491714	.51760195	30.388189 / .000	-1.4880173 / -2.65887
MISREQ	5.8478266	1.2043564	23.578027 / .000	.7687218 / 4.77698
(CONSTANT)	-5.4744783	1.0469632	27.341439 / .000	

---------- VARIABLES NOT IN THE EQUATION ------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
INTERFAC	3.4858626	.44341848	7.8614800	2.5989896 , 4.3728156
OPCHAR	-2.8491714	.51760195	-5.5045688	-3.8845295 , -1.8138133
MISREQ	5.8478266	1.2043564	4.8546973	3.4379551 , 8.2560981
CONSTANT	-5.4744783	1.0469632	-5.2289842	-7.5687885 , -3.3802321

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

MISREQ	1.45047		
OPCHAR	-.49230	.26791	
INTERFAC	.27760	-.19948	.19661

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OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0	
1.	1.000000	1.009248	-.9247516E-02		I	
2.	1.000000	1.009248	-.9247516E-02		I	
3.	1.000000	1.009248	-.9247516E-02		I	
4.	1.000000	1.009248	-.9247516E-02		I	
5.	1.000000	1.009248	-.9247516E-02		I	
6.	1.000000	1.009248	-.9247516E-02		I	
7.	1.000000	1.009248	-.9247516E-02		I	
8.	1.070000	1.041082	.2891792E-01		I	
9.	1.000000	1.009248	-.9247516E-02		I	
10.	1.000000	1.009248	-.9247516E-02		I	
11.	1.000000	1.009248	-.9247516E-02		I	
12.	1.000000	1.009248	-.9247516E-02		I	
13.	1.000000	1.009248	-.9247516E-02		I	
14.	1.000000	1.009248	-.9247516E-02		I	
15.	1.320000	1.371205	-.5120516E-01		I	
16.	1.060000	1.028348	.3165175E-01		I	
17.	1.000000	1.009248	-.9247516E-02		I	
18.	1.000000	1.009248	-.9247516E-02		I	
19.	1.000000	1.009248	-.9247516E-02		I	
20.	1.000000	1.009248	-.9247516E-02		I	
21.	1.000000	1.009248	-.9247516E-02		I	
22.	1.610000	1.698981	-.8898092E-01		I	
23.	1.320000	1.371205	-.5120516E-01		I	
24.	1.060000	1.028348	.3165175E-01		I	
25.	1.000000	1.009248	-.9247516E-02		I	
26.	1.000000	1.009248	-.9247516E-02		I	
27.	1.000000	1.009248	-.9247516E-02		I	
28.	1.000000	1.009248	-.9247516E-02		I	
29.	4.240000	2.749601	1.490399		I	R
30.	1.320000	1.371205	-.5120516E-01		I	
31.	1.060000	1.028348	.3165175E-01		I	
32.	1.000000	1.009248	-.9247516E-02		I	
33.	1.000000	1.009248	-.9247516E-02		I	
34.	1.000000	1.009248	-.9247516E-02		I	
35.	1.660000	2.461173	-.8011733	R	I	
36.	1.000000	1.009248	-.9247516E-02		I	
37.	1.000000	1.009248	-.9247516E-02		I	
38.	1.060000	1.028348	.3165175E-01		I	
39.	1.320000	1.371205	-.5120516E-01		I	
40.	4.240000	2.749601	1.490399		I	R
41.	1.760000	2.560060	-.8000601	R	I	
42.	1.100000	1.028348	.7165175E-01		I	
43.	1.060000	1.028348	.3165175E-01		I	
44.	1.320000	1.371205	-.5120516E-01		I	
45.	1.000000	1.009248	-.9247516E-02		I	
46.	1.170000	.8131484	.3568516		I	
47.	1.320000	1.371205	-.5120516E-01		I	
48.	1.000000	1.009248	-.9247516E-02		I	
49.	1.480000	1.748921	-.2689207		I	
50.	1.170000	.8131484	.3568516		I	

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0
53.	1.170000	.8131484	.3568516		I
54.	1.480000	1.748921	-.2689207		I
55.	1.900000	1.975424	-.7542423E-01		I
56.	1.060000	1.409088	-.3490878		I
57.	1.170000	.8131484	.3568516		I
58.	1.480000	1.374229	.1057708		I
59.	1.060000	1.409088	-.3490878		I
60.	1.220000	2.031968	-.8119682	R	I
61.	1.480000	1.374229	.1057708		I
62.	1.530000	1.212670	.3173301		I
63.	1.220000	2.031968	-.8119682	R	I
64.	1.550000	1.194569	.3554314		I

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 64.
NUMBER OF 2 S.D. OUTLIERS 6. OR 9.38 PERCENT OF THE TOTAL

VON NEUMANN RATIO 2.53410 DURBIN-WATSON TEST 2.49451

NUMBER OF POSITIVE RESIDUALS 17.
NUMBER OF NEGATIVE RESIDUALS 47.
NUMBER OF RUNS OF SIGNS 28.

EXPECTED NUMBER OF RUNS OF SIGNS 26.
EXPECTED S.D. OF RUN DISTRIBUTION 3.08213
UNIT NORMAL DEVIATE-
Z=(EXPECTED-OBSERVED)/S.D. .82127
PROBABILITY OF OBTAINING .GE. ABS(Z) .20575

DEPENDENT VARIABLE.. INTERFAC INTERFACE REQMTS

MEAN RESPONSE 1.16986 STD. DEV. .25584

VARIABLE(S) ENTERED ON STEP NUMBER 1.. OPCHAR OPERATIONAL CHARACTERISTICS

MULTIPLE R	.87447	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFIC
R SQUARE	.76469	REGRESSION	1.	3.15340	3.15340	201.40607	0
ADJUSTED R SQUARE	.76090	RESIDUAL	62.	.97034	.01565		
STD DEVIATION	.12510	COEFF OF VARIABILITY	10.7 PCT				

---------- VARIABLES IN THE EQUATION ----------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
OPCHAR	.73302862	.51641449E-01	201.40607 / .000	.8744675 / .73234
(CONSTANT)	.31290797	.62309821E-01	25.218558 / .000	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
DERSS	.56428	.79341	28.497489 / .000
MISREQ	-.51983	.36115	22.587581 / .000

* *

VARIABLE(S) ENTERED ON STEP NUMBER 2.. DERSS DESIGN REQMT*SPEC STANDARDS

MULTIPLE R	.91631	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.83962	REGRESSION	2.	3.46237	1.73119	159.67211	0
ADJUSTED R SQUARE	.83436	RESIDUAL	61.	.66137	.01084		
STD DEVIATION	.10413	COEFF OF VARIABILITY	8.9 PCT				

---------- VARIABLES IN THE EQUATION ----------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
OPCHAR	.61594529	.40254677E-01	162.93165 / 0	.7347928 / .61537
DERSS	.13453401	.25201640E-01	28.497489 / .000	.3073021 / .14403
(CONSTANT)	.28127992	.52199008E-01	29.037037 / .000	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
MISREQ	-.68744	.35877	53.759694 / .000

DEPENDENT VARIABLE.. INTERFAC INTERFACE REQMTS

VARIABLE(S) ENTERED ON STEP NUMBER 3.. MISREQ MISSION REQUIREMENTS

		ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
MULTIPLE R	.95677	REGRESSION	3.	3.77492	1.25831	216.43630	0
R SQUARE	.91541	RESIDUAL	60.	.34882	.00581		
ADJUSTED R SQUARE	.91118	COEFF OF VARIABILITY	6.5 PCT				
STD DEVIATION	.07625						

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
OPCHAR	.91430015	.53892458E-01	287.82041 / 0	1.0907156 / .91344
DERSS	.14555960	.18515547E-01	61.802868 / .000	.3324866 / .15563
MISREQ	-1.5466063	.21093633	53.759694 / .000	-.4596253 / -1.35271
(CONSTANT)	1.5084165	.17061002	77.341136 / .000	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
OPCHAR	.91430015	.53892458E-01	16.965271	.80649918 , 1.0221011
DERSS	.14555960	.18515547E-01	7.8614000	.10852299 , .18259621
MISREQ	-1.5466063	.21093633	-7.3321003	-1.9685418 , -1.1246708
CONSTANT	1.5084165	.17061002	8.7943009	1.1591441 , 1.8416890

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

	DERSS	MISREQ	OPCHAR
DERSS	.00034		
MISREQ	-.00032	.04449	
OPCHAR	-.00024	-.00058	.00290

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0	
1.	1.000000	1.013670	-.1366995E-01		I	
2.	1.000000	1.013670	-.1366995E-01		I	
3.	1.000000	1.013670	-.1366995E-01		I	
4.	1.000000	1.013670	-.1366995E-01		I	
5.	1.000000	1.013670	-.1366995E-01		I	
6.	1.000000	1.013670	-.1366995E-01		I	
7.	1.000000	1.013670	-.1366995E-01		I	
8.	1.050000	1.069574	-.1957413E-01		I	
9.	1.000000	1.013670	-.1366995E-01		I	
10.	1.000000	1.013670	-.1366995E-01		I	
11.	1.000000	1.013670	-.1366995E-01		I	
12.	1.000000	1.013670	-.1366995E-01		I	
13.	1.000000	1.013670	-.1366995E-01		I	
14.	1.000000	1.013670	-.1366995E-01		I	
15.	1.300000	1.279681	.2031894E-01		I	
16.	1.030000	1.049833	-.1983253E-01		I	
17.	1.000000	1.013670	-.1366995E-01		I	
18.	1.000000	1.013670	-.1366995E-01		I	
19.	1.000000	1.013670	-.1366995E-01		I	
20.	1.000000	1.013670	-.1366995E-01		I	
21.	1.000000	1.013670	-.1366995E-01		I	
22.	1.310000	1.230463	.7953667E-01		I	
23.	1.300000	1.279681	.2031894E-01		I	
24.	1.030000	1.049833	-.1983253E-01		I	
25.	1.000000	1.013670	-.1366995E-01		I	
26.	1.000000	1.013670	-.1366995E-01		I	
27.	1.000000	1.013670	-.1366995E-01		I	
28.	1.000000	1.013670	-.1366995E-01		I	
29.	1.680000	1.743511	-.6351106E-01		I	
30.	1.300000	1.279681	.2031894E-01		I	
31.	1.030000	1.049833	-.1983253E-01		I	
32.	1.000000	1.013670	-.1366995E-01		I	
33.	1.000000	1.013670	-.1366995E-01		I	
34.	1.000000	1.013670	-.1366995E-01		I	
35.	1.420000	1.149902	.2700984		I	R
36.	1.000000	1.013670	-.1366995E-01		I	
37.	1.000000	1.013670	-.1366995E-01		I	
38.	1.030000	1.049833	-.1983253E-01		I	
39.	1.300000	1.279681	.2031894E-01		I	
40.	1.680000	1.743511	-.6351106E-01		I	
41.	1.780000	1.499158	.2808417		I	R
42.	1.030000	1.055655	-.2565492E-01		I	
43.	1.030000	1.049833	-.1983253E-01		I	
44.	1.300000	1.279681	.2031894E-01		I	
45.	1.000000	1.013670	-.1366995E-01		I	
46.	1.050000	1.157274	-.1072741		I	
47.	1.300000	1.279681	.2031894E-01		I	
48.	1.000000	1.013670	-.1366995E-01		I	
49.	1.580000	1.494974	.8502637E-01		I	
50.	1.050000	1.157274	-.1072741		I	

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD 0.0
53.	1.850000	1.157274	-.1072741	
54.	1.500000	1.494974	.8502637E-01	
55.	2.070000	2.031545	.3845526E-01	
56.	1.270000	1.196121	.7387944E-01	
57.	1.850000	1.157274	-.1072741	
58.	1.260000	1.257256	.2744412E-02	
59.	1.270000	1.196121	.7387944E-01	
60.	1.500000	1.385612	.1143879	
61.	1.260000	1.257256	.2744412E-02	
62.	1.230000	1.282828	-.5281957E-01	
63.	1.500000	1.385612	.1143879	
64.	1.930000	2.183373	-.2533729	R

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 64.
NUMBER OF 2 S.D. OUTLIERS 3. OR 4.69 PERCENT OF THE TOTAL

VON NEUMANN RATIO 2.34692 DURBIN-WATSON TEST 2.31025

NUMBER OF POSITIVE RESIDUALS 19.
NUMBER OF NEGATIVE RESIDUALS 45.
NUMBER OF RUNS OF SIGNS 27.

EXPECTED NUMBER OF RUNS OF SIGNS 28.
EXPECTED S.D. OF RUN DISTRIBUTION 3.30265
UNIT NORMAL DEVIATE-
Z=(EXPECTED-OBSERVED)/S.D. -.06623
PROBABILITY OF OBTAINING .GE. ABS(Z) .47368

APPENDIX EIGHT

COMPUTER RUN WITH 60 RAW DATA POINTS

APPENDIX EIGHT

COMPUTER RUN WITH 60 RAW DATA POINTS

MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS 31 AUG 78 PAGE 2

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

VARIABLE	MEAN	STANDARD DEV	CASES
MISREQ	8.1167	2.8765	60
OPCHAR	95.1667	69.5397	60
DERSS	295.8667	141.7821	60
INTERFAC	57.5500	29.7039	60
TIME	11.6333	8.2441	60

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

	MISREQ	OPCHAR	DERSS	INTERFAC
OPCHAR	.11005			
DERSS	.09837	-.01654		
INTERFAC	-.31379	.34686	.53799	
TIME	-.00603	-.14588	.17968	.08950

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. MISREQ MISSION REQUIREMENTS

MEAN RESPONSE 8.11667 STD. DEV. 2.87651

VARIABLE(S) ENTERED ON STEP NUMBER 1.. TIME TIME FROM SPEC START

MULTIPLE R	.00683	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.00004	REGRESSION	1.	.01774	.01774	.00211	.96
ADJUSTED R SQUARE	-.01720	RESIDUAL	58.	488.16568	8.41665		
STD DEVIATION	2.90115	COEFF OF VARIABILITY	35.7 PCT				

------------------- VARIABLES IN THE EQUATION ---------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
TIME	-.21031106E-02	.45814295E-01	.21072798E-02 / .964	-.0060275 / -.00301
(CONSTANT)	8.1411329	.65141285	156.19176 / 0	

---------- VARIABLES NOT IN THE EQUATION ------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
TIME	-.21031106E-02	.45814295E-01	-.45905117E-01	-.93810387E-01, .89604166E-01
CONSTANT	8.1411329	.65141285	12.497670	6.8371900 , 9.4450758

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME	.00210
	TIME

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. OPCHAR OPERATIONAL CHARACTERISTICS

MEAN RESPONSE 95.16667 STD. DEV. 69.53969

VARIABLE(S) ENTERED ON STEP NUMBER 1.. TIME TIME FROM SPEC START

MULTIPLE R	.14588	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.02128	REGRESSION	1.	6071.83298	6071.83298	1.26117	.266
ADJUSTED R SQUARE	.00441	RESIDUAL	58.	279238.50036	4814.45690		
STD DEVIATION	69.38629	COEFF OF VARIABILITY	72.9 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
TIME	-1.2305275	1.0957338	1.2611668 .266	-.1458818 -.15042
(CONSTANT)	109.40180	15.579727	49.381489 .000	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
TIME	-1.2305275	1.0957338	-1.1230168	-3.4238771 , .96282208
CONSTANT	109.40180	15.579727	7.0271964	78.295591 , 140.66082

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME	1.20063
	TIME

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. DERSS DESIGN REQMT+SPEC STANDARDS

MEAN RESPONSE 295.86667 STD. DEV. 141.78286

VARIABLE(S) ENTERED ON STEP NUMBER 1.. TIME TIME FROM SPEC START

MULTIPLE R	.17968	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.03226	REGRESSION	1.	38258.65288	38258.65288	1.93332	.17
ADJUSTED R SQUARE	.01557	RESIDUAL	58.	1147768.28845	19789.10828		
STD DEVIATION	140.67377	COEFF OF VARIABILITY	47.5 PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
TIME	3.6888468	2.2214989	1.9333187 / .170	.1796846 / .12145
(CONSTANT)	259.93389	31.586348	67.721188 / .000	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
TIME	3.0888460	2.2214989	1.3904383	-1.3579512 , 7.5356432
CONSTANT	259.93389	31.586348	8.2292880	196.70616 , 323.16002

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME	4.93502
	TIME

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MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS                              31 AUG 78      PAGE    9

FILE    HARD      (CREATION DATE =  31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..     INTERFAC    INTERFACE REQMTS

MEAN RESPONSE        57.55000      STD. DEV.       29.70386

VARIABLE(S) ENTERED ON STEP NUMBER   1..    TIME        TIME FROM SPEC START

MULTIPLE R              .08950         ANALYSIS OF VARIANCE     DF       SUM OF SQUARES          MEAN SQUARE           F       SIGNIFI
R SQUARE                .00801         REGRESSION                1.           416.99137            416.99137        .46835     .496
ADJUSTED R SQUARE     -.00909          RESIDUAL                 58.         51639.85863            890.34239
STD DEVIATION         29.83861         COEFF OF VARIABILITY     51.8 PCT


-------------------- VARIABLES IN THE EQUATION ---------------------        ---------- VARIABLES NOT IN THE EQUATION -- ---

VARIABLE            B           STD ERROR B          F           BETA         VARIABLE      PARTIAL     TOLERANCE        F
                                               ------------  ----------                                            -----------
                                               SIGNIFICANCE  ELASTICITY                                            SIGNIFICANC

TIME            .32247419      .47120586      .46834946     .0895003
                                                    .496        .06519
(CONSTANT)     53.798550      6.6998445      64.470821
                                                    .000

ALL VARIABLES ARE IN THE EQUATION.


COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE          B           STD ERROR B         T            95.0 PCT CONFIDENCE INTERVAL

TIME          .32247419      .47120586      .68436862       -.62074523   ,  1.2656936
CONSTANT     53.798550      6.6998445      8.0298207        40.387354   ,  67.209746

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME          .22203
           TIME
```

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* * * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..   MISREQ     MISSION REQUIREMENTS

MEAN RESPONSE        8.11667     STD. DEV.        2.87651

VARIABLE(S) ENTERED ON STEP NUMBER   1..   INTERFAC   INTERFACE REQMTS

MULTIPLE R               .31579      ANALYSIS OF VARIANCE     DF      SUM OF SQUARES      MEAN SQUARE          F      SIGNIFI
R SQUARE                 .09846      REGRESSION                1.          48.06763         48.06763      6.33452     .015
ADJUSTED R SQUARE        .08292      RESIDUAL                 58.         440.11570          7.58820
STD DEVIATION           2.75467      COEFF OF VARIABILITY     33.9 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION -------
VARIABLE             B            STD ERROR B          F            BETA        VARIABLE      PARTIAL     TOLERANCE         F
                                                 ------------  ----------                                              -----------
                                                 SIGNIFICANCE  ELASTICITY                                              SIGNIFICANC

INTERFAC   -.30386971E-01    .12073425E-01     6.3345219     -.3137870      OPCHAR        .24580      .87960       3.6652231
                                                    .015     -.21545                                                       .061
(CONSTANT)  9.8654369         .78054639       159.74792                     DERSS         .33382      .71057       7.1484042
                                                    0                                                                      .010

* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

VARIABLE(S) ENTERED ON STEP NUMBER   2..   DERSS      DESIGN REQMT=SPEC STANDARDS

MULTIPLE R               .44601      ANALYSIS OF VARIANCE     DF      SUM OF SQUARES      MEAN SQUARE          F      SIGNIFI
R SQUARE                 .19893      REGRESSION                2.          97.11211         48.55605      7.07721     .0
ADJUSTED R SQUARE        .17082      RESIDUAL                 57.         391.07123          6.86090
STD DEVIATION           2.61933      COEFF OF VARIABILITY     32.3 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION -------
VARIABLE             B            STD ERROR B          F            BETA        VARIABLE      PARTIAL     TOLERANCE         F
                                                 ------------  ----------                                              -----------
                                                 SIGNIFICANCE  ELASTICITY                                              SIGNIFICANC

INTERFAC   -.49976727E-01    .13619133E-01    13.465941      -.5160779      OPCHAR        .36397      .82160       8.5516080
                                                    .001     -.35435                                                       .005
DERSS       .76286145E-02    .28532585E-02     7.1484042     .3760118
                                                    .010      .27800
(CONSTANT)  8.7357746         .85403654       104.62040
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* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..     MISREQ      MISSION REQUIREMENTS

VARIABLE(S) ENTERED ON STEP NUMBER   3..   OPCHAR     OPERATIONAL CHARACTERISTICS

                                         ANALYSIS OF VARIANCE    DF      SUM OF SQUARES       MEAN SQUARE           F      SIGNIFIC
MULTIPLE R              .55231           REGRESSION              3.          148.92088           49.64003       8.19376      0
R SQUARE                .30505           RESIDUAL               56.          339.26326            6.05827
ADJUSTED R SQUARE       .26782           COEFF OF VARIABILITY   30.3 PCT
STD DEVIATION          2.46136

-------------------- VARIABLES IN THE EQUATION ----------------------         ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE            B             STD ERROR B         F            BETA        VARIABLE      PARTIAL     TOLERANCE        F
                                                 ------------  ----------                                            -----------
                                                 SIGNIFICANCE  ELASTICITY                                            SIGNIFICANC

INTERFAC     -.67402274E-01    .14117015E-01     22.796248    -.6960205
                                                      .000     -.47791
DERSS         .97132843E-02    .27793261E-02     12.257931     .4787645
                                                      .001      .35407
OPCHAR        .14866492E-01    .50837540E-02      8.5516000    .3593981
                                                      .005      .17431
(CONSTANT)   7.7073360         .87624569         77.361164
                                                      .000

ALL VARIABLES ARE IN THE EQUATION.


COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE          B              STD ERROR B         T             95.0 PCT CONFIDENCE INTERVAL

INTERFAC    -.67402274E-01     .14117015E-01  -4.7745416          -.95682053E-01,  -.39122495E-01
DERSS        .97132843E-02     .27793261E-02   3.5011329           .41556413E-02,   .15270927E-01
OPCHAR       .14866492E-01     .50837540E-02   2.9243133           .46825068E-02,   .25050476E-01
CONSTANT    7.7073360          .87624569       8.7955195          5.9517050    ,   9.4623671

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.


OPCHAR        .00003
DERSS         .00000       .00001
INTERFAC     -.00003      -.00002       .00020
```

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL
1.	11.00000	8.789651	2.210349
2.	8.000000	10.51600	-2.516000
3.	9.000000	6.515897	2.484103
4.	11.00000	8.792936	2.207064
5.	6.000000	8.379801	-2.379801
6.	8.000000	7.520632	.4793675
7.	8.000000	7.520632	.4793675
8.	11.00000	8.789651	2.210349
9.	11.00000	8.789651	2.210349
10.	11.00000	8.789651	2.210349
11.	11.00000	8.789651	2.210349
12.	11.00000	8.789651	2.210349
13.	8.000000	10.51600	-2.516000
14.	8.000000	10.51600	-2.516000
15.	8.000000	10.51600	-2.516000
16.	8.000000	10.51600	-2.516000
17.	9.000000	6.515897	2.484103
18.	9.000000	6.515897	2.484103
19.	9.000000	6.515897	2.484103
20.	9.000000	6.515897	2.484103
21.	9.000000	6.515897	2.484103
22.	3.000000	6.437112	-3.437112
23.	3.000000	6.437112	-3.437112
24.	3.000000	6.437112	-3.437112
25.	3.000000	6.437112	-3.437112
26.	3.000000	6.437112	-3.437112
27.	3.000000	6.437112	-3.437112
28.	3.000000	6.437112	-3.437112
29.	3.000000	6.437112	-3.437112
30.	11.00000	8.792936	2.207064
31.	6.000000	8.379801	-2.379801
32.	6.000000	8.379801	-2.379801
33.	8.000000	7.454349	.5456508
34.	8.000000	7.454349	.5456508
35.	8.000000	7.454349	.5456508
36.	8.000000	7.454349	.5456508
37.	8.000000	7.454349	.5456508
38.	11.00000	8.910679	2.089321
39.	11.00000	8.910679	2.089321
40.	11.00000	8.910679	2.089321
41.	11.00000	8.910679	2.089321
42.	11.00000	8.910679	2.089321
43.	6.000000	8.478221	-2.478221
44.	7.000000	12.18793	-5.187932
45.	9.000000	12.33391	-3.333914
46.	11.00000	9.276429	1.723571
47.	9.000000	6.882807	2.117193
48.	11.00000	8.858314	2.141686
49.	11.00000	8.858314	2.141686
50.	11.00000	8.858314	2.141686

-2SD . 0.0

FILE HARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0
53.	8.000000	7.187463	.8125367		I
54.	3.000000	5.500999	-2.500999		I
55.	3.000000	5.500999	-2.500999		I
56.	3.000000	5.500999	-2.500999		I
57.	8.000000	6.665414	1.334586		I
58.	11.00000	9.753122	1.246878		I
59.	11.00000	9.753122	1.246878		I
60.	11.00000	9.855999	1.144001		I

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 60.
NUMBER OF 2 S.D. OUTLIERS 1. OR 1.67 PERCENT OF THE TOTAL

VON NEUMANN RATIO .93138 DURBIN-WATSON TEST .91586

NUMBER OF POSITIVE RESIDUALS 38.
NUMBER OF NEGATIVE RESIDUALS 22.
NUMBER OF RUNS OF SIGNS 15.

EXPECTED NUMBER OF RUNS OF SIGNS 29.
EXPECTED S.D. OF RUN DISTRIBUTION 3.56228
UNIT NORMAL DEVIATE-
Z=(EXPECTED-OBSERVED)/S.D. -3.75232
PROBABILITY OF OBTAINING .GE. ABS(Z) .00089

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FILE    NAME     (CREATION DATE =  31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * *   M U L T I P L E    R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..     OPCHAR       OPERATIONAL CHARACTERISTICS

MEAN RESPONSE         95.16667        STD. DEV.        69.53969

VARIABLE(S) ENTERED ON STEP NUMBER    1..    INTERFAC    INTERFACE REQMTS

MULTIPLE R              .34686        ANALYSIS OF VARIANCE      DF       SUM OF SQUARES        MEAN SQUARE           F       SIGNIFI
R SQUARE                .12032        REGRESSION                 1.        34327.16840         34327.16840        7.93271      .0
ADJUSTED R SQUARE       .10515        RESIDUAL                  58.       250983.16493          4327.29595
STD DEVIATION         65.78219        COEFF OF VARIABILITY      69.1 PCT

-------------------- VARIABLES IN THE EQUATION ----------------------        ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE           B            STD ERROR B         F             BETA          VARIABLE      PARTIAL     TOLERANCE         F
                                               ------------   -----------                                                ----------
                                               SIGNIFICANCE   ELASTICITY                                                 SIGNIFICANC

INTERFAC       .81234491        .28831641        7.9327864       .3468648        MISREQ         .24580       .90158     3.6652231
                                                      .007         .49187                                                      .061
(CONSTANT)    48.433482       18.639643         6.7517480                        DERSS         -.25695       .71857     4.0295041
                                                      .012                                                                     .049

* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

VARIABLE(S) ENTERED ON STEP NUMBER    2..    DERSS      DESIGN REQMTS/SPEC STANDARDS

MULTIPLE R              .42237        ANALYSIS OF VARIANCE      DF       SUM OF SQUARES        MEAN SQUARE           F       SIGNIFI
R SQUARE                .17840        REGRESSION                 2.        58898.45964         25449.22982        6.18828      .0
ADJUSTED R SQUARE       .14957        RESIDUAL                  57.       234911.87370          4112.48981
STD DEVIATION         64.12869        COEFF OF VARIABILITY      67.4 PCT

-------------------- VARIABLES IN THE EQUATION ----------------------        ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE           B            STD ERROR B         F             BETA          VARIABLE      PARTIAL     TOLERANCE         F
                                               ------------   -----------                                                ----------
                                               SIGNIFICANCE   ELASTICITY                                                 SIGNIFICANC

INTERFAC      1.1721358         .33343511        12.357574       .5006776        MISREQ         .36397       .80107     8.5516080
                                                      .001         .70882                                                      .005
DERSS         -.14022608        .69855883E-01    4.0295041      -.2659021
                                                      .049        -.43595
(CONSTANT)    69.190473        20.909240        10.952579
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FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. OPCHAR OPERATIONAL CHARACTERISTICS

VARIABLE(S) ENTERED ON STEP NUMBER 3.. MISREQ MISSION REQUIREMENTS

MULTIPLE R	.53595
R SQUARE	.28724
ADJUSTED R SQUARE	.24906
STD DEVIATION	60.26099

ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIF.
REGRESSION	3.	81952.65819	27317.55273	7.52262	0
RESIDUAL	56.	203357.67514	3631.38706		
COEFF OF VARIABILITY	63.3 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
INTERFAC	1.6174844	.34837535	21.556852	.6909081
			.000	.97814
DERSS	-.20820557	.69637374E-01	8.9392258	-.4245031
			.004	-.64730
MISREQ	8.9111188	3.0472518	8.5516088	.3686082
			.005	.76002
(CONSTANT)	-8.6470511	33.085960	.68304382E-01	
			.795	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
INTERFAC	1.6174844	.34837535	4.6429357	.91960466 ,	2.3153640
DERSS	-.20820557	.69637374E-01	-2.9898538	-.34770599 ,	-.68705144E-01
MISREQ	8.9111188	3.0472518	2.9243133	2.8067399 ,	15.015498
CONSTANT	-8.6470511	33.085960	-.26135107	-74.926194 ,	57.632092

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

MISREQ	9.28574		
DERSS	-.07[illegible]84	.00485	
INTERFAC	.46407	-.01401	.12137

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0
1.	61.00000	88.71658	-27.71658		. I
2.	69.00000	28.90967	40.09033		I .
3.	117.0000	155.0940	-38.09398		. I
4.	63.00000	92.91035	-29.91035		. I
5.	229.0000	114.0811	114.9189		I .
6.	121.0000	112.6224	8.377597		I .
7.	121.0000	112.6224	8.377597		I .
8.	61.00000	88.71658	-27.71658		. I
9.	61.00000	88.71658	-27.71658		. I
10.	61.00000	88.71658	-27.71658		. I
11.	61.00000	88.71658	-27.71658		. I
12.	61.00000	88.71658	-27.71658		. I
13.	69.00000	28.90967	40.09033		I .
14.	69.00000	28.90967	40.09033		I .
15.	69.00000	28.90967	40.09033		I .
16.	69.00000	28.90967	40.09033		I .
17.	117.0000	155.0940	-38.09398		. I
18.	117.0000	155.0940	-38.09398		. I
19.	117.0000	155.0940	-38.09398		. I
20.	117.0000	155.0940	-38.09398		. I
21.	117.0000	155.0940	-38.09398		. I
22.	16.00000	61.11380	-45.11380		. I
23.	16.00000	61.11380	-45.11380		. I
24.	16.00000	61.11380	-45.11380		. I
25.	16.00000	61.11380	-45.11380		. I
26.	16.00000	61.11380	-45.11380		. I
27.	16.00000	61.11380	-45.11380		. I
28.	16.00000	61.11380	-45.11380		. I
29.	16.00000	61.11380	-45.11380		. I
30.	63.00000	92.91035	-29.91035		. I
31.	229.0000	114.0811	114.9189		I .
32.	229.0000	114.0811	114.9189		I .
33.	150.0000	125.5297	24.47032		I .
34.	150.0000	125.5297	24.47032		I .
35.	150.0000	125.5297	24.47032		I .
36.	150.0000	125.5297	24.47032		I .
37.	150.0000	125.5297	24.47032		I .
38.	65.00000	91.19655	-26.19655		. I
39.	65.00000	91.19655	-26.19655		. I
40.	65.00000	91.19655	-26.19655		. I
41.	65.00000	91.19655	-26.19655		. I
42.	65.00000	91.19655	-26.19655		. I
43.	261.0000	125.4501	135.5499		I R
44.	361.0000	91.36323	269.6368		I R
45.	85.00000	5.851981	79.14802		I .
46.	86.00000	88.66695	-2.666951		.I
47.	120.0000	148.7033	-28.70334		. I
48.	71.00000	95.43995	-24.43995		. I
49.	71.00000	95.43995	-24.43995		. I
50.	71.00000	95.43995	-24.43995		. I

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MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS                                   31 AUG 78  .   PAGE  20

FILE   WARD     (CREATION DATE =  31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * *

OBSERVATION     Y VALUE       Y ESTIMATE       RESIDUAL       -2SD                     0.0

   53.         176.0000        141.6082        34.39179                                 I       *
   54.         19.00000        85.07154       -66.07154                    *            I
   55.         19.00000        85.07154       -66.07154                    *            I
   56.         19.00000        85.07154       -66.07154                    *            I
   57.         248.0000        166.6225        81.37746                                 I         *
   58.         75.00000        77.53427       -2.534270                                *I
   59.         75.00000        77.53427       -2.534270                                *I
   60.         76.00000        75.82047        .1795345                                 *

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
       R INDICATES POINT OUT OF RANGE OF PLOT


NUMBER OF CASES PLOTTED        60.
NUMBER OF 2 S.D. OUTLIERS       2. OR   3.33 PERCENT OF THE TOTAL

VON NEUMANN RATIO    1.01005          DURBIN-WATSON TEST     .99319

NUMBER OF POSITIVE RESIDUALS     22.
NUMBER OF NEGATIVE RESIDUALS     38.
NUMBER OF RUNS OF SIGNS          16.

EXPECTED NUMBER OF RUNS OF SIGNS          29.
EXPECTED S.D. OF RUN DISTRIBUTION     3.56224
UNIT NORMAL DEVIATE-
  Z=(EXPECTED-OBSERVED)/S.D.         -3.47160
PROBABILITY OF OBTAINING .GE. ABS(Z)   .00026
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FILE    WARD      (CREATION DATE =  31 AUG 78)    WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * * *   M U L T I P L E    R E G R E S S I O N   * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..    DERSS       DESIGN REQMT&SPEC STANDARDS

MEAN RESPONSE      295.86667       STD. DEV.      141.78206

VARIABLE(S) ENTERED ON STEP NUMBER   1..    INTERFAC    INTERFACE REQMTS

MULTIPLE R              .53799        ANALYSIS OF VARIANCE      DF        SUM OF SQUARES         MEAN SQUARE              F      SIGNIFI
R SQUARE                .28943        REGRESSION                 1.         343276.91027        343276.91027          23.62511      0
ADJUSTED R SQUARE       .27718        RESIDUAL                  58.         842750.82306         14530.17281
STD DEVIATION        120.54117        COEFF OF VARIABILITY      40.7 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE           B           STD ERROR B          F            BETA          VARIABLE      PARTIAL      TOLERANCE          F
                                               ------------   ----------                                                ----------
                                               SIGNIFICANCE   ELASTICITY                                                SIGNIFICANC

INTERFAC      2.5679310       .52831926        23.625109      .5379910          MISRED        .33382        .90154      7.1484042
                                                    .000        .49950                                                       .010
(CONSTANT)    148.08224       34.155817        18.796482                        UPCHAR       -.25695        .87968      4.0295041
                                                    .000                                                                     .049

* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

VARIABLE(S) ENTERED ON STEP NUMBER   2..    MISRED      MISSION REQUIREMENTS

MULTIPLE R              .60714        ANALYSIS OF VARIANCE      DF        SUM OF SQUARES         MEAN SQUARE              F      SIGNIFI
R SQUARE                .36862        REGRESSION                 2.         437189.11073        218594.55537          16.63897      0
ADJUSTED R SQUARE       .34646        RESIDUAL                  57.         748837.82260         13137.50566
STD DEVIATION        114.61896        COEFF OF VARIABILITY      38.7 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE           B           STD ERROR B          F            BETA          VARIABLE      PARTIAL      TOLERANCE          F
                                               ------------   ----------                                                ----------
                                               SIGNIFICANCE   ELASTICITY                                                SIGNIFICANC

INTERFAC      3.0118104       .52908513        32.404412      .6309854          UPCHAR       -.37102        .82654      8.9392258
                                                       0        .58584                                                       .004
MISRED        14.607557       5.4635261        7.1484042      .2963615
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FILE HARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. DERSS DESIGN REQMT&SPEC STANDARDS

VARIABLE(S) ENTERED ON STEP NUMBER 3.. OPCHAR OPERATIONAL CHARACTERISTICS

MULTIPLE R	.67493	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFIC
R SQUARE	.45553	REGRESSION	3.	540270.57378	180090.19126	15.61742	0
ADJUSTED R SQUARE	.42636	RESIDUAL	56.	645756.35955	11531.36356		
STD DEVIATION	107.38419	COEFF OF VARIABILITY	36.3 PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
INTERFAC	3.6666198	.54191637	45.779096 / .000	.7681704 / .71321
MISREQ	18.488342	5.2806742	12.257931 / .001	.3750958 / .50720
OPCHAR	-.66115070	.22113145	8.9392258 / .000	-.3242739 / -.21266
(CONSTANT)	-2.2915036	58.993838	.15087865E-02 / .969	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
INTERFAC	3.6666198	.54191637	6.7660251	2.5810308 , 4.7522087
MISREQ	18.488342	5.2806742	3.5011329	7.9098804 , 29.066004
OPCHAR	-.66115070	.22113145	-2.9898538	-1.1041302 , -.21817118
CONSTANT	-2.2915036	58.993838	-.38843101E-01	-120.47036 , 115.88736

VARIABLE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

MISREQ	27.88552		
OPCHAR	-.28743	.4890	
INTERFAC	1.08043	-.0843	.29367

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0
1.	143.0000	226.7492	-83.74922		
2.	364.0000	195.3279	168.6721		
3.	531.0000	526.7433	4.256682		
4.	286.0000	302.4259	-16.42594		
5.	149.0000	184.5655	-35.56547		
6.	94.0000	223.2806	-129.2806		
7.	94.0000	223.2806	-129.2806		
8.	143.0000	226.7492	-83.74922		
9.	143.0000	226.7492	-83.74922		
10.	143.0000	226.7492	-83.74922		
11.	143.0000	226.7492	-83.74922		
12.	143.0000	226.7492	-83.74922		
13.	364.0000	195.3279	168.6721		
14.	364.0000	195.3279	168.6721		
15.	364.0000	195.3279	168.6721		
16.	364.0000	195.3279	168.6721		
17.	531.0000	526.7433	4.256682		
18.	531.0000	526.7433	4.256682		
19.	531.0000	526.7433	4.256682		
20.	531.0000	526.7433	4.256682		
21.	531.0000	526.7433	4.256682		
22.	275.0000	269.9255	5.074461		
23.	275.0000	269.9255	5.074461		
24.	275.0000	269.9255	5.074461		
25.	275.0000	269.9255	5.074461		
26.	275.0000	269.9255	5.074461		
27.	275.0000	269.9255	5.074461		
28.	275.0000	269.9255	5.074461		
29.	275.0000	269.9255	5.074461		
30.	286.0000	302.4259	-16.42594		
31.	149.0000	184.5655	-35.56547		
32.	149.0000	184.5655	-35.56547		
33.	133.0000	251.7733	-118.7733		
34.	133.0000	251.7733	-118.7733		
35.	133.0000	251.7733	-118.7733		
36.	133.0000	251.7733	-118.7733		
37.	133.0000	251.7733	-118.7733		
38.	302.0000	304.7703	-2.770255		
39.	302.0000	304.7703	-2.770255		
40.	302.0000	304.7703	-2.770255		
41.	302.0000	304.7703	-2.770255		
42.	302.0000	304.7703	-2.770255		
43.	242.0000	233.0744	8.925581		
44.	632.0000	270.4411	361.5589		R
45.	603.0000	243.5707	359.4293		R
46.	252.0000	261.5531	-9.553132		
47.	585.0000	535.7597	49.24027		
48.	336.0000	326.4697	9.530311		
49.	336.0000	326.4697	9.530311		
50.	336.0000	326.4697	9.530311		

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL
53.	149.0000	278.5829	-129.5829
54.	292.0000	330.2746	-38.27462
55.	292.0000	330.2746	-38.27462
56.	292.0000	330.2746	-38.27462
57.	192.0000	334.4250	-142.4250
58.	422.0000	323.8251	98.17491
59.	422.0000	323.8251	98.17491
60.	438.0000	326.8306	111.1694

-250   0.0

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 60.
NUMBER OF 2 S.D. OUTLIERS 2. OR 3.33 PERCENT OF THE TOTAL

VON NEUMANN RATIO .90808   DURBIN-WATSON TEST .89294

NUMBER OF POSITIVE RESIDUALS 30.
NUMBER OF NEGATIVE RESIDUALS 30.
NUMBER OF RUNS OF SIGNS 10.

EXPECTED NUMBER OF RUNS OF SIGNS 31.
EXPECTED S.D. OF RUN DISTRIBUTION 3.84002
UNIT NORMAL DEVIATE-
Z=(EXPECTED-OBSERVED)/S.D. -5.33851
PROBABILITY OF OBTAINING .GE. ABS(Z) .00000

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE..   INTERFAC   INTERFACE REQMTS

MEAN RESPONSE   57.55000   STD. DEV.   29.70386

VARIABLE(S) ENTERED ON STEP NUMBER 1..   DERSS   DESIGN REQMT+SPEC STANDARDS

MULTIPLE R	.53799	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.28943	REGRESSION	1.	15067.03948	15067.03948	23.62511	0
ADJUSTED R SQUARE	.27718	RESIDUAL	58.	36989.81052	637.75535		
STD DEVIATION	25.25382	COEFF OF VARIABILITY	43.9 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
DERSS	.11271118	.23188880E-01	23.625109 .000	.5379910 .57945
(CONSTANT)	24.202543	7.5960557	10.151862 .002	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
MISREQ	-.43715	.99032	13.465941 .001
OPCHAR	.42210	.99973	12.357574 .001

* *

VARIABLE(S) ENTERED ON STEP NUMBER 2..   MISREQ   MISSION REQUIREMENTS

MULTIPLE R	.65209	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.42522	REGRESSION	2.	22135.73976	11067.86988	21.08440	0
ADJUSTED R SQUARE	.40505	RESIDUAL	57.	29921.11024	524.93176		
STD DEVIATION	22.91139	COEFF OF VARIABILITY	39.8 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
DERSS	.12834209	.21195511E-01	32.404412 0	.5744152 .61868
MISREQ	-3.8237514	1.0420086	13.465941 .001	-.3702982 -.53929
(CONSTANT)	52.98901	10.440084	25.753169	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
OPCHAR	.52721	.98713	21.556852 .000

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FILE   WARD     (CREATION DATE =  31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..     INTERFAC   INTERFACE REQMTS

VARIABLE(S) ENTERED ON STEP NUMBER   3..   OPCHAR     OPERATIONAL CHARACTERISTICS

                                    ANALYSIS OF VARIANCE     DF       SUM OF SQUARES      MEAN SQUARE            F      SIGNIFI
MULTIPLE R              .76480      REGRESSION               3.          30452.28341      10150.76114     26.31123        0
R SQUARE                .58490      RESIDUAL                56.          21604.56659        385.79583
ADJUSTED R SQUARE       .56275      COEFF OF VARIABILITY    34.1 PCT
STD DEVIATION         19.64169

-------------------- VARIABLES IN THE EQUATION ----------------------        ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE            B          STD ERROR B          F            BETA        VARIABLE      PARTIAL     TOLERANCE         F
                                               ------------  ----------                                             ----------
                                               SIGNIFICANCE  ELASTICITY                                             SIGNIFICANC

DERSS          .12267124     .18130473E-01     45.779096       .5855326
                                                    .000         .63066
MISREQ        -4.2922329     .89898325         22.796248      -.4156577
                                                    .000        -.60536
OPCHAR         .17184032     .37011135E-01     21.556852       .4022952
                                                    .000         .28416
(CONSTANT)    39.740823     9.3934837          17.898653
                                                    .000

ALL VARIABLES ARE IN THE EQUATION.


COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE            B         STD ERROR B          T              95.0 PCT CONFIDENCE INTERVAL

DERSS          .12267124    .18130473E-01    6.7660251          .86351535E-01,   .15899894
MISREQ        -4.2922329    .89898325       -4.7745416        -6.0931128    ,  -2.4913531
OPCHAR         .17184032    .37011135E-01    4.6429357          .97698100E-01,   .24598254
CONSTANT      39.740823    9.3934837         4.2306799         20.923414    ,   58.558232

VARIABLE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

DERSS          .00033
MISREQ        -.00164      .80817
OPCHAR         .00002     -.00373      .00137

               DERSS       MISREQ      OPCHAR
```

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0
1.	18.00000	20.55051	-2.550508		I
2.	26.00000	61.91227	-35.91227		I
3.	120.0000	86.35447	33.64553		I
4.	39.00000	38.43618	.5638249		I
5.	62.00000	71.61687	-9.616874		I
6.	43.00000	37.72674	5.273265		I
7.	43.00000	37.72674	5.273265		I
8.	18.00000	20.55051	-2.550508		I
9.	18.00000	20.55051	-2.550508		I
10.	18.00000	20.55051	-2.550508		I
11.	18.00000	20.55051	-2.550508		I
12.	18.00000	20.55051	-2.550508		I
13.	26.00000	61.91227	-35.91227		I
14.	26.00000	61.91227	-35.91227		I
15.	26.00000	61.91227	-35.91227		I
16.	26.00000	61.91227	-35.91227		I
17.	120.0000	86.35447	33.64553		I
18.	120.0000	86.35447	33.64553		I
19.	120.0000	86.35447	33.64553		I
20.	120.0000	86.35447	33.64553		I
21.	120.0000	86.35447	33.64553		I
22.	62.00000	63.34816	-1.348160		I
23.	62.00000	63.34816	-1.348160		I
24.	62.00000	63.34816	-1.348160		I
25.	62.00000	63.34816	-1.348160		I
26.	62.00000	63.34816	-1.348160		I
27.	62.00000	63.34816	-1.348160		I
28.	62.00000	63.34816	-1.348160		I
29.	62.00000	63.34816	-1.348160		I
30.	39.00000	38.43618	.5638249		I
31.	62.00000	71.61687	-9.616874		I
32.	62.00000	71.61687	-9.616874		I
33.	56.00000	47.49428	8.505717		I
34.	56.00000	47.49428	8.505717		I
35.	56.00000	47.49428	8.505717		I
36.	56.00000	47.49428	8.505717		I
37.	56.00000	47.49428	8.505717		I
38.	40.00000	40.74260	-.7425956		I
39.	40.00000	40.74260	-.7425956		I
40.	40.00000	40.74260	-.7425956		I
41.	40.00000	40.74260	-.7425956		I
42.	40.00000	40.74260	-.7425956		I
43.	81.00000	88.52419	-7.524189		I
44.	104.0000	149.0859	-45.08593	R	I
45.	37.00000	89.68791	-52.68791	R	I
46.	32.00000	38.21768	-6.217680		I
47.	123.0000	93.49424	29.50576		I
48.	47.00000	45.94446	1.055540		I
49.	47.00000	45.94446	1.055540		I
50.	47.00000	45.94446	1.055540		I
51.	47.00000	45.94446	1.055540		I
52.	68.00000	53.92487	14.07513		I

MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS 31 AUG 78 PAGE 30

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0
53.	68.00000	53.92487	14.07513		I
54.	79.00000	65.94909	13.05091		I
55.	79.00000	65.94909	13.05091		I
56.	79.00000	65.94909	13.05091		I
57.	89.00000	64.69862	24.30138		I
58.	47.00000	57.18155	-10.18155		I
59.	47.00000	57.18155	-10.18155		I
60.	48.00000	59.31613	-11.31613		I

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 60.
NUMBER OF 2 S.D. OUTLIERS 2. OR 3.33 PERCENT OF THE TOTAL

VON NEUMANN RATIO 1.05329 DURBIN-WATSON TEST 1.03573

NUMBER OF POSITIVE RESIDUALS 26.
NUMBER OF NEGATIVE RESIDUALS 34.
NUMBER OF RUNS OF SIGNS 13.

EXPECTED NUMBER OF RUNS OF SIGNS 30.
EXPECTED S.D. OF RUN DISTRIBUTION 3.77058
UNIT NORMAL DEVIATE-
Z=(EXPECTED-OBSERVED)/S.D. -4.49975
PROBABILITY OF OBTAINING .GE. ABS(Z) .00000

APPENDIX NINE

COMPUTER RUN WITH 60 TRANSFORMED DATA POINTS

APPENDIX NINE

COMPUTER RUN WITH 60 TRANSFORMED DATA POINTS

FILE HARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

VARIABLE	MEAN	STANDARD DEV	CASES
MISRLQ	1.8075	.8336	60
OPCHAR	1.1288	.1753	60
DERSS	1.2630	.6146	60
INTERFAC	1.1482	.2355	60
TIME	13.1333	7.7229	60

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

	MISREQ	OPCHAR	DERSS	INTERFAC
OPCHAR	.47428			
DERSS	.86721	.76490		
INTERFAC	.45174	.95727	.69115	
TIME	.01438	.34225	.14226	.34604

FILE WAHD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I L E R E G R E S S I O N *

DEPENDENT VARIABLE.. MISREQ MISSION REQUIREMENTS

MEAN RESPONSE 1.04750 STD. DEV. .03358

VARIABLE(S) ENTERED ON STEP NUMBER 1.. TIME TIME FROM SPEC START

		ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
MULTIPLE R	.01438	REGRESSION	1.	.00001	.00001	.01199	.913
R SQUARE	.00021	RESIDUAL	58.	.06651	.00115		
ADJUSTED R SQUARE	-.01703	COEFF OF VARIABILITY	3.4 PCT				
STD DEVIATION	.03386						

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
TIME	.62518945E-04	.57085791E-03	.11994888E-01 / .913	.0143789 / .00001
(CONSTANT)	1.0066789	.86787927E-02	13454.368 / .000	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
TIME	.62518945E-04	.57085791E-03	.10951752	-.10801773E-02, .12052152E-02
CONSTANT	1.0066789	.86787927E-02	115.99297	.98930643 , 1.0240514

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME	.00000
	TIME

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MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS                                  31 AUG 78     PAGE    5

FILE   WARD     (CREATION DATE =  31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..    OPCHAR     OPERATIONAL CHARACTERISTICS

MEAN RESPONSE        1.12083      STD. DEV.        .17534

VARIABLE(S) ENTERED ON STEP NUMBER   1..   TIME       TIME FROM SPEC START

MULTIPLE R            .34225        ANALYSIS OF VARIANCE    DF      SUM OF SQUARES       MEAN SQUARE           F      SIGNIFI
R SQUARE              .11714        REGRESSION               1.            .21247            .21247        7.69524     0
ADJUSTED R SQUARE     .10191        RESIDUAL                58.           1.60139            .02761
STD DEVIATION         .16616        COEFF OF VARIABILITY    14.8 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE          B            STD ERROR B          F            BETA           VARIABLE      PARTIAL    TOLERANCE        F
                                               ------------   ----------                                              -----------
                                               SIGNIFICANCE   ELASTICITY                                              SIGNIFICANC

TIME        .77703471E-02   .28011037E-02   7.6952449       .3422506
                                                 .007          .09105
(CONSTANT)  1.0187828       .42585376E-01   572.32434
                                                   0

ALL VARIABLES ARE IN THE EQUATION.


COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE          B            STD ERROR B          T           95.0 PCT CONFIDENCE INTERVAL

TIME        .77703471E-02   .28011037E-02   2.7740304         .21633287E-02,  .13377365E-01
CONSTANT    1.0187828       .42585376E-01   23.923301         .93353888    ,  1.1040267

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME          .00001

              TIME
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MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS                                  31 AUG 78 . PAGE    7

FILE   HARD     (CREATION DATE = 31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * * * *   M U L T I P L E   R E G R E S S I O N   * * * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..    DERSS      DESIGN REQMT-SPEC STANDARDS

MEAN RESPONSE          1.26300      STD. DEV.          .61455

VARIABLE(S) ENTERED ON STEP NUMBER   1..    TIME       TIME FROM SPEC START

MULTIPLE R            .14226        ANALYSIS OF VARIANCE     DF      SUM OF SQUARES        MEAN SQUARE            F      SIGNIFI
R SQUARE              .02024        REGRESSION                1.               .45096            .45096        1.19806     .28
ADJUSTED R SQUARE     .00335        RESIDUAL                 58.             21.83198            .37641
STD DEVIATION         .61352        COEFF OF VARIABILITY     48.6 PCT

--------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE           B           STD ERROR B          F           BETA           VARIABLE      PARTIAL     TOLERANCE         F
                                               ------------  -----------                                                -----------
                                               SIGNIFICANCE  ELASTICITY                                                 SIGNIFICANC

TIME         .11320476E-01   .10342517E-01    1.1980554      .1422606
                                                   .278        .11772
(CONSTANT)   1.1143244       .15723800       50.223649
                                                   .000

ALL VARIABLES ARE IN THE EQUATION.


COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE           B          STD ERROR B          T             95.0 PCT CONFIDENCE INTERVAL

TIME         .11320476E-01   .10342517E-01   1.0945572        -.930232U5E-02,  .32023272E-01
CONSTANT     1.1143244       .15723800       7.0866645         .79957836    ,  1.4290705

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME          .00011

            TIME
```

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MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS                               31 AUG 78     PAGE    9

FILE    WARD     (CREATION DATE = 31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * * M U L T I P L E   R E G R E S S I O N * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..   INTERFAC   INTERFACE REQMTS

MEAN RESPONSE        1.14817      STD. DEV.        .23545

VARIABLE(S) ENTERED ON STEP NUMBER   1..   TIME       TIME FROM SPEC START

MULTIPLE R            .34604       ANALYSIS OF VARIANCE    DF      SUM OF SQUARES      MEAN SQUARE         F     SIGNIFI
R SQUARE              .11974       REGRESSION               1.            .39166           .39166      7.88978     0
ADJUSTED R SQUARE     .10457       RESIDUAL                58.           2.87923           .04964
STD DEVIATION         .22280       COEFF OF VARIABILITY    19.4 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------        ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE          B          STD ERROR B         F            BETA          VARIABLE      PARTIAL     TOLERANCE       F
                                              ------------   -----------                                            -----------
                                              SIGNIFICANCE   ELASTICITY                                             SIGNIFICANC

TIME        .18549977E-01   .37559427E-02    7.8897882       .3460378
                                                  .007          .12068
(CONSTANT)  1.0096103       .57101868E-01    312.61300
                                                  0

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE          B          STD ERROR B         T              95.0 PCT CONFIDENCE INTERVAL

TIME        .18549977E-01   .37559427E-02  2.8088760          .30316410E-02,  .18068314E-01
CONSTANT    1.0096103       .57101860E-01  17.680865          .89530851    ,  1.1239121

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME           .00001

               TIME
```

DEPENDENT VARIABLE.. MISREQ MISSION REQUIREMENTS

MEAN RESPONSE 1.00750 STD. DEV. .03358

VARIABLE(S) ENTERED ON STEP NUMBER 1.. DERSS DESIGN REQMT*SPEC STANDARDS

MULTIPLE R	.86721	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.75205	REGRESSION	1.	.05003	.05003	175.92126	0
ADJUSTED R SQUARE	.74778	RESIDUAL	58.	.01649	.00028		
STD DEVIATION	.01686	COEFF OF VARIABILITY	1.7 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
DERSS	.47303953E-01	.35724991E-02	175.92126 0	.8672101 .05940
(CONSTANT)	.94765407	.50098408E-02	35780.830 0	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
OPCHAR	-.58963	.41493	30.377960 .000
INTERFAC	-.41023	.52231	11.533626 .001

* *

VARIABLE(S) ENTERED ON STEP NUMBER 2.. OPCHAR OPERATIONAL CHARACTERISTICS

MULTIPLE R	.91556	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.83825	REGRESSION	2.	.05576	.02788	147.70313	0
ADJUSTED R SQUARE	.83258	RESIDUAL	57.	.01076	.00019		
STD DEVIATION	.01374	COEFF OF VARIABILITY	1.4 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
DERSS	.66433319E-01	.45185333E-02	216.16079 0	1.2158071 .08328
OPCHAR	-.87289212E-01	.15837305E-01	30.377960 .000	-.4557953 -.09711
(CONSTANT)	1.0214314	.13994208E-01	5327.4088	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
INTERFAC	.42075	.07956	12.045947 .001

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FILE   WARD     (CREATION DATE =  31 AUG 78)    WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E    R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..     MISREQ     MISSION REQUIREMENTS

VARIABLE(S) ENTERED ON STEP NUMBER    3..    INTERFAC    INTERFACE REQMTS

MULTIPLE R              .93117        ANALYSIS OF VARIANCE     DF      SUM OF SQUARES        MEAN SQUARE            F      SIGNIFI
R SQUARE                .86689        REGRESSION               3.               .05767            .01922       121.56618      0
ADJUSTED R SQUARE       .85976        RESIDUAL                56.               .00886            .00016
STD DEVIATION           .01257        COEFF OF VARIABILITY     1.2 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE            B           STD ERROR B          F            BETA          VARIABLE       PARTIAL     TOLERANCE        F
                                                ------------   -----------                                              -----------
                                                SIGNIFICANCE   ELASTICITY                                               SIGNIFICANC

DERSS        .69677496E-01    .42398733E-02     270.07185      1.2752213
                                                     .000         .08735
OPCHAR      -.20596446        .37138644E-01     30.756186     -1.0754780
                                                     .000        -.22913
INTERFAC     .85553393E-01    .24649991E-01     12.045947       .5998992
                                                     .001
(CONSTANT)  1.0521196         .15563725E-01    4569.8627         .09750
                                                     0

ALL VARIABLES ARE IN THE EQUATION.


COEFFICIENTS AND CONFIDENCE INTERVALS.

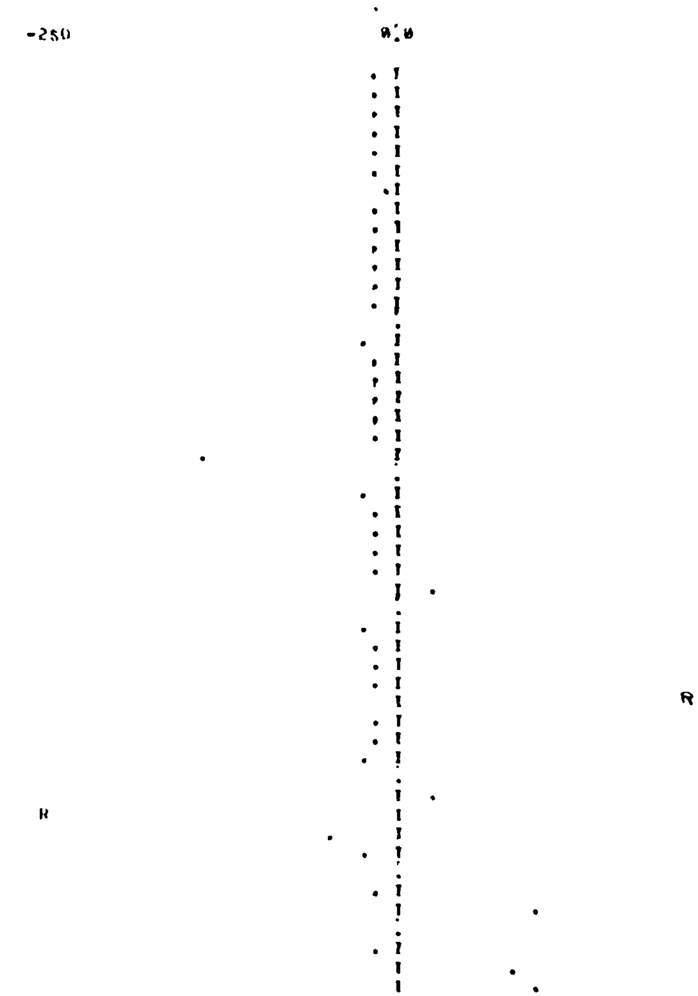
VARIABLE         B            STD ERROR B          T              95.0 PCT CONFIDENCE INTERVAL

DERSS        .69677496E-01    .42398733E-02  16.433863         .61184010E-01,   .78170983E-01
OPCHAR      -.20596446        .37138644E-01 -5.5458260        -.28036210    ,  -.13156681
INTERFAC     .85553393E-01    .24649991E-01  3.4707271         .36173526E-01,   .13493326
CONSTANT    1.0521196         .15563725E-01  67.600759        1.0209417     ,  1.0832975

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

OPCHAR        .00138
DERSS        -.00008      .00002
INTERFAC     -.00084      .00002      .00061
```

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL
1.	1.000000	1.001386	-.1386029E-02
2.	1.000000	1.001386	-.1386029E-02
3.	1.000000	1.001386	-.1386029E-02
4.	1.000000	1.001386	-.1386029E-02
5.	1.000000	1.001386	-.1386029E-02
6.	1.000000	1.001386	-.1386029E-02
7.	1.000000	1.000243	-.2429000E-03
8.	1.000000	1.001386	-.1386029E-02
9.	1.000000	1.001386	-.1386029E-02
10.	1.000000	1.001386	-.1386029E-02
11.	1.000000	1.001386	-.1386029E-02
12.	1.000000	1.001386	-.1386029E-02
13.	1.000000	1.001386	-.1386029E-02
14.	1.000000	.9999174	.8262369E-04
15.	1.000000	1.001954	-.1954347E-02
16.	1.000000	1.001386	-.1386029E-02
17.	1.000000	1.001386	-.1386029E-02
18.	1.000000	1.001386	-.1386029E-02
19.	1.000000	1.001386	-.1386029E-02
20.	1.000000	1.001386	-.1386029E-02
21.	1.000000	1.014113	-.1411255E-01
22.	1.000000	.9999174	.8262369E-04
23.	1.000000	1.001954	-.1954347E-02
24.	1.000000	1.001386	-.1386029E-02
25.	1.000000	1.001386	-.1386029E-02
26.	1.000000	1.001386	-.1386029E-02
27.	1.000000	1.001386	-.1386029E-02
28.	1.170000	1.167918	.2082316E-02
29.	1.000000	.9999174	.8262369E-04
30.	1.000000	1.001954	-.1954347E-02
31.	1.000000	1.001386	-.1386029E-02
32.	1.000000	1.001386	-.1386029E-02
33.	1.000000	1.001386	-.1386029E-02
34.	1.110000	1.035934	.7406622E-01
35.	1.000000	1.001386	-.1386029E-02
36.	1.000000	1.001386	-.1386029E-02
37.	1.000000	1.001954	-.1954347E-02
38.	1.000000	.9999174	.8262369E-04
39.	1.170000	1.167918	.2082316E-02
40.	1.000000	1.036627	-.3662715E-01
41.	1.000000	1.004741	-.4741447E-02
42.	1.000000	1.001954	-.1954347E-02
43.	1.000000	.9999174	.8262369E-04
44.	1.000000	1.001386	-.1386029E-02
45.	1.000000	.9907335	.9266506E-02
46.	1.000000	.9999174	.8262369E-04
47.	1.000000	1.001386	-.1386029E-02
48.	1.000000	.9917682	.8231810E-02
49.	1.000000	.9907335	.9266506E-02



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FILE HARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0
53.	1.000000	.9917682	.8231810E-02		I
54.	1.000000	1.007343	-.7343497E-02		I
55.	1.000000	.9891328	.1086715E-01		I
56.	1.000000	.9907335	.9266506E-02		I
57.	1.000000	1.017942	-.1794186E-01		I
58.	1.000000	.9891328	.1086715E-01		I
59.	1.000000	1.017942	-.1794186E-01		I
60.	1.000000	1.014740	-.1473985E-01		I

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 60.
NUMBER OF 2 S.D. OUTLIERS 2. OR 3.33 PERCENT OF THE TOTAL

VON NEUMANN RATIO 2.04387 DURBIN-WATSON TEST 2.00981

NUMBER OF POSITIVE RESIDUALS 18.
NUMBER OF NEGATIVE RESIDUALS 42.
NUMBER OF RUNS OF SIGNS 23.

EXPECTED NUMBER OF RUNS OF SIGNS 26.
EXPECTED S.D. OF RUN DISTRIBUTION 3.21581
UNIT NORMAL DEVIATE-
Z=(EXPECTED-OBSERVED)/S.D. -.83981
PROBABILITY OF OBTAINING .GE. ABS(Z) .20051

```
DEPENDENT VARIABLE..   OPCHAR     OPERATIONAL CHARACTERISTICS

MEAN RESPONSE        1.12083     STD. DEV.       .17534

VARIABLE(S) ENTERED ON STEP NUMBER   1..    INTERFAC    INTERFACE REQMTS

MULTIPLE R             .95727        ANALYSIS OF VARIANCE     DF      SUM OF SQUARES       MEAN SQUARE            F      SIGNIFI
R SQUARE               .91637        REGRESSION                1.           1.66217           1.66217       635.54797       0
ADJUSTED R SQUARE      .91493        RESIDUAL                 58.            .15169            .00262
STD DEVIATION          .05114        COEFF OF VARIABILITY     4.6 PCT


-------------------- VARIABLES IN THE EQUATION ---------------------        ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE          B           STD ERROR B          F            BETA         VARIABLE    PARTIAL    TOLERANCE         F
                                              ------------  -----------                                          -----------
                                              SIGNIFICANCE  ELASTICITY                                           SIGNIFICANC

INTERFAC     .71285972      .28276777E-01    635.54797      .9572732        MISREQ      .16188      .79593     1.5338614
                                                     0       .73024                                                  .221
(CONSTANT)   .30235157      .33130944E-01    83.203091                      DERSS       .49417      .52231     18.416769
                                                  .000                                                                .000

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VARIABLE(S) ENTERED ON STEP NUMBER   2..    DERSS      DESIGN REQMT+SPEC STANDARDS

MULTIPLE R             .96788        ANALYSIS OF VARIANCE     DF      SUM OF SQUARES       MEAN SQUARE            F      SIGNIFIC
R SQUARE               .93679        REGRESSION                2.           1.69921            .84961       427.40644       0
ADJUSTED R SQUARE      .93458        RESIDUAL                 57.            .11465            .00201
STD DEVIATION          .04485        COEFF OF VARIABILITY     4.0 PCT


-------------------- VARIABLES IN THE EQUATION ---------------------        ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE          B           STD ERROR B          F            BETA         VARIABLE    PARTIAL    TOLERANCE         F
                                              ------------  -----------                                          -----------
                                              SIGNIFICANCE  ELASTICITY                                           SIGNIFICANC

INTERFAC     .61148883      .34311990E-01    317.18968      .8206888        MISREQ     -.59541      .20622     30.756186
                                                     0       .62599                                                   .000
DERSS        .56415650E-01  .13145977E-01    18.416769      .1977349
                                                  .000       .06357
(CONSTANT)   .34794854      .30936330E-01    126.50057
```

DEPENDENT VARIABLE.. UPCHAR OPERATIONAL CHARACTERISTICS

VARIABLE(S) ENTERED ON STEP NUMBER 3.. MISREQ MISSION REQUIREMENTS

MULTIPLE R	.97939	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.95920	REGRESSION	3.	1.73986	.57995	430.86060	0
ADJUSTED R SQUARE	.95702	RESIDUAL	56.	.07400	.00132		
STD DEVIATION	.03635	COEFF OF VARIABILITY	3.2 PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
INTERFAC	.54170731	.30496251E-01	315.52698 / 0	.7274389 / .55492
DERSS	.15634680	.20934021E-01	55.779252 / .000	.5479902 / .17618
MISREQ	-1.7212333	.31036555	30.756186 / .000	-.3296329 / -1.54719
(CONSTANT)	2.0355396	.30533076	44.444497 / .000	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
INTERFAC	.54170731	.30496251E-01	17.763079	.48061598 , .60279865
DERSS	.15634680	.20934021E-01	7.4685500	.11441092 , .19828269
MISREQ	-1.7212333	.31036555	-5.5458260	-2.3429702 , -1.0994964
CONSTANT	2.0355396	.30533076	6.6666706	1.4238886 , 2.6471906

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

MISREQ	.09633		
DERSS	-.00559	.00044	
INTERFAC	.00388	-.00043	.00093

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OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0 (plot)
1.	1.030000	1.012360	-.1236041E-01		. I
2.	1.040000	1.012360	-.1236041E-01		. I
3.	1.000000	1.012360	-.1236041E-01		. I
4.	1.000000	1.012360	-.1236041E-01		. I
5.	1.000000	1.012360	-.1236041E-01		. I
6.	1.000000	1.012360	-.1236041E-01		. I
7.	1.050000	1.050390	-.3900407E-03		.I
8.	1.000000	1.012360	-.1236041E-01		. I
9.	1.000000	1.012360	-.1236041E-01		. I
10.	1.000000	1.012360	-.1236041E-01		. I
11.	1.000000	1.012360	-.1236041E-01		. I
12.	1.000000	1.012360	-.1236041E-01		. I
13.	1.000000	1.012360	-.1236041E-01		. I
14.	1.240000	1.224904	.1509642E-01		I .
15.	1.030000	1.037992	-.7992434E-02		. I
16.	1.000000	1.012360	-.1236041E-01		. I
17.	1.000000	1.012360	-.1236041E-01		. I
18.	1.000000	1.012360	-.1236041E-01		. I
19.	1.000000	1.012360	-.1236041E-01		. I
20.	1.000000	1.012360	-.1236041E-01		. I
21.	1.500000	1.380414	.1195864		I R
22.	1.240000	1.224904	.1509642E-01		I .
23.	1.030000	1.037992	-.7992434E-02		. I
24.	1.000000	1.012360	-.1236041E-01		. I
25.	1.000000	1.012360	-.1236041E-01		. I
26.	1.000000	1.012360	-.1236041E-01		. I
27.	1.000000	1.012360	-.1236041E-01		. I
28.	1.570000	1.594675	-.2467536E-01		. I
29.	1.240000	1.224904	.1509642E-01		I .
30.	1.030000	1.037992	-.7992434E-02		. I
31.	1.000000	1.012360	-.1236041E-01		. I
32.	1.000000	1.012360	-.1236041E-01		. I
33.	1.000000	1.012360	-.1236041E-01		. I
34.	1.230000	1.153731	.7626930E-01		I R
35.	1.000000	1.012360	-.1236041E-01		. I
36.	1.000000	1.012360	-.1236041E-01		. I
37.	1.030000	1.037992	-.7992434E-02		. I
38.	1.240000	1.224904	.1509642E-01		I .
39.	1.570000	1.594675	-.2467536E-01		. I
40.	1.410000	1.553716	-.1437157	R	I
41.	1.030000	1.044246	-.1424631E-01		. I
42.	1.030000	1.037992	-.7992434E-02		. I
43.	1.240000	1.224904	.1509642E-01		I .
44.	1.000000	1.012360	-.1236041E-01		. I
45.	1.130000	1.066025	.6397527E-01		I .
46.	1.240000	1.224904	.1509642E-01		I .
47.	1.000000	1.012360	-.1236041E-01		. I
48.	1.450000	1.401597	.4840289E-01		I .
49.	1.130000	1.066025	.6397527E-01		I .
50.	1.000000	1.012360	-.1236041E-01		. I

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0
53.	1.450000	1.401597	.4840289E-01		I
54.	1.720000	1.732699	-.1269936E-01		I
55.	1.190000	1.168802	.2199781E-01		I
56.	1.130000	1.066025	.6397527E-01		I
57.	1.190000	1.228251	-.3825077E-01		I
58.	1.190000	1.168002	.2199781E-01		I
59.	1.190000	1.228251	-.3825077E-01		I
60.	1.210000	1.219817	-.9816895E-02		I

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 60.
NUMBER OF 2 S.D. OUTLIERS 3. OR 5.00 PERCENT OF THE TOTAL

VON NEUMANN RATIO 1.78642 DURBIN-WATSON TEST 1.75664

NUMBER OF POSITIVE RESIDUALS 17.
NUMBER OF NEGATIVE RESIDUALS 43.
NUMBER OF RUNS OF SIGNS 23.

EXPECTED NUMBER OF RUNS OF SIGNS 25.
EXPECTED S.D. OF RUN DISTRIBUTION 3.10649
UNIT NORMAL DEVIATE-
Z=(EXPECTED-OBSERVED)/S.D. -.60089
PROBABILITY OF OBTAINING .GE. ABS(Z) .27396

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FILE   WARD     (CREATION DATE =  31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..     DERSS      DESIGN REQMT*SPEC STANDARDS

MEAN RESPONSE          1.26300      STD. DEV.         .61455

VARIABLE(S) ENTERED ON STEP NUMBER   1..   MISREQ     MISSION REQUIREMENTS

MULTIPLE R              .86721        ANALYSIS OF VARIANCE      DF      SUM OF SQUARES        MEAN SQUARE            F      SIGNIFI
R SQUARE                .75285        REGRESSION                 1.          16.75790          16.75790         175.92126        0
ADJUSTED R SQUARE       .74778        RESIDUAL                  58.           5.52496           .09526
STD DEVIATION           .30864        COEFF OF VARIABILITY      24.4 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE           B          STD ERROR B          F             BETA          VARIABLE       PARTIAL     TOLERANCE        F
                                               ------------   ----------                                              -----------
                                               SIGNIFICANCE   ELASTICITY                                              SIGNIFICANC

MISREQ        15.871477       1.1966253        175.92126       .8672101       OPCHAR          .80672       .77513      106.23849
                                                       0      12.66074                                                       0
(CONSTANT)   -14.727513       1.2062582        149.06588                      INTERFAC        .67395       .79593      47.435483
                                                       0                                                                     0

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VARIABLE(S) ENTERED ON STEP NUMBER   2..   OPCHAR     OPERATIONAL CHARACTERISTICS

MULTIPLE R              .95573        ANALYSIS OF VARIANCE      DF      SUM OF SQUARES        MEAN SQUARE            F      SIGNIFIC
R SQUARE                .91342        REGRESSION                 2.          20.35355          10.17677         300.66451       0
ADJUSTED R SQUARE       .91038        RESIDUAL                  57.           1.92931           .03385
STD DEVIATION           .18398        COEFF OF VARIABILITY      14.6 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION ------

VARIABLE           B          STD ERROR B          F             BETA          VARIABLE       PARTIAL     TOLERANCE        F
                                               ------------   ----------                                              -----------
                                               SIGNIFICANCE   ELASTICITY                                              SIGNIFICANC

MISREQ        11.911669       .81018490        216.16079       .6508480       INTERFAC       -.46580       .88362      15.516786
                                                       0       9.59198                                                    .000
OPCHAR        1.5991879       .15515826        106.23849       .4562635
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FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. DERSS DESIGN REQMT+SPEC STANDARDS

VARIABLE(S) ENTERED ON STEP NUMBER 3.. INTERFAC INTERFACE REQMTS

MULTIPLE R	.96551	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.93220	REGRESSION	3.	20.77214	6.92405	256.66410	0
ADJUSTED R SQUARE	.92857	RESIDUAL	56.	1.51072	.02698		
STD DEVIATION	.16425	COEFF OF VARIABILITY	13.0 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
MISREQ	11.887033	.72332557	270.07185	.6495019
			.000	9.40233
OPCHAR	3.1917030	.42735239	55.779252	.9106232
			.000	2.83244
INTERFAC	-1.2371013	.31405403	15.516786	-.4739727
			.000	-1.12462
(CONSTANT)	-12.870155	.67507615	363.46450	
			0	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
MISREQ	11.887033	.72332557	16.433863	10.438038	, 13.336028
OPCHAR	3.1917030	.42735239	7.4685500	2.3356133	, 4.0477928
INTERFAC	-1.2371013	.31405403	-3.9391351	-1.8662271	, -.60797544
CONSTANT	-12.870155	.67507615	-19.064745	-14.222495	, -11.517815

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

MISREQ	.52320		
OPCHAR	-.05044	.18263	
INTERFAC	.00196	-.12697	.09863

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0
1.	1.000000	.9714003	.2851970E-01		I .
2.	1.000000	.9714003	.2851970E-01		I .
3.	1.000000	.9714003	.2851970E-01		I .
4.	1.000000	.9714003	.2851970E-01		I .
5.	1.000000	.9714003	.2851970E-01		I .
6.	1.000000	.9714003	.2851970E-01		I .
7.	1.070000	1.069210	.7896072E-03		.
8.	1.000000	.9714003	.2851970E-01		I .
9.	1.000000	.9714003	.2851970E-01		I .
10.	1.000000	.9714003	.2851970E-01		I .
11.	1.000000	.9714003	.2851970E-01		I .
12.	1.000000	.9714003	.2851970E-01		I .
13.	1.000000	.9714003	.2851970E-01		I .
14.	1.320000	1.366359	-.4635866E-01		. I
15.	1.060000	1.030118	.2988164E-01		I .
16.	1.000000	.9714003	.2851970E-01		I .
17.	1.000000	.9714003	.2851970E-01		I .
18.	1.000000	.9714003	.2851970E-01		I .
19.	1.000000	.9714003	.2851970E-01		I .
20.	1.000000	.9714003	.2851970E-01		I .
21.	2.280000	2.183830	.9616956E-01		I .
22.	1.320000	1.366359	-.4635866E-01		. I
23.	1.060000	1.030118	.2988164E-01		I .
24.	1.000000	.9714003	.2851970E-01		I .
25.	1.000000	.9714003	.2851970E-01		I .
26.	1.000000	.9714003	.2851970E-01		I .
27.	1.000000	.9714003	.2851970E-01		I .
28.	4.240000	3.970318	.2696822		I .
29.	1.320000	1.366359	-.4635866E-01		. I
30.	1.060000	1.030118	.2988164E-01		I .
31.	1.000000	.9714003	.2851970E-01		I .
32.	1.000000	.9714003	.2851970E-01		I .
33.	1.000000	.9714003	.2851970E-01		I .
34.	1.660000	2.493563	-.8335631	R	I
35.	1.000000	.9714003	.2851970E-01		I .
36.	1.000000	.9714003	.2851970E-01		I .
37.	1.060000	1.030118	.2988164E-01		I .
38.	1.320000	1.366359	-.4635866E-01		. I
39.	4.240000	3.970318	.2696822		I
40.	1.760000	1.315140	.4448600		I . R
41.	1.100000	1.030118	.6988164E-01		I .
42.	1.060000	1.030118	.2988164E-01		I .
43.	1.320000	1.366359	-.4635866E-01		. I
44.	1.000000	.9714003	.2851970E-01		I .
45.	1.170000	1.324547	-.1545466		. I
46.	1.320000	1.366359	-.4635866E-01		. I
47.	1.000000	.9714003	.2851970E-01		I .
48.	1.480000	1.690228	-.2102279		. I
49.	1.170000	1.324547	-.1545466		. I
50.	1.000000	.9714003	.2851970E-01		I .
51.	1.060000	1.243087	-.1838065		. I
52.	1.170000	1.324547	-.1545466		. I

MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS   31 AUG 78   PAGE 25

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0
53.	1.400000	1.698228	-.2182279		I
54.	1.900000	1.945808	-.4580815E-01		I
55.	1.060000	1.243887	-.1838865		I
56.	1.170000	1.324547	-.1545466		I
57.	1.480000	1.256258	.2237424		I
58.	1.060000	1.243887	-.1838865		I
59.	1.480000	1.256258	.2237424		I
60.	1.530000	1.357205	.1727953		I

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 60.
NUMBER OF 2 S.D. OUTLIERS 2. OR 3.33 PERCENT OF THE TOTAL

VON NEUMANN RATIO 1.81914   DURBIN-WATSON TEST 1.78882

NUMBER OF POSITIVE RESIDUALS 43.
NUMBER OF NEGATIVE RESIDUALS 17.
NUMBER OF RUNS OF SIGNS 21.

EXPECTED NUMBER OF RUNS OF SIGNS 25.
EXPECTED S.D. OF RUN DISTRIBUTION 3.10649
UNIT NORMAL DEVIATE-
Z=(EXPECTED-OBSERVED)/S.D. -1.29470
PROBABILITY OF OBTAINING .GE. ABS(Z) .18662

FILE HARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. INTERFAC INTERFACE REQMTS

MEAN RESPONSE 1.14817 STD. DEV. .23545

VARIABLE(S) ENTERED ON STEP NUMBER 1.. OPCHAR OPERATIONAL CHARACTERISTICS

MULTIPLE R	.95727	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.91637	REGRESSION	1.	2.99736	2.99736	635.54797	0
ADJUSTED R SQUARE	.91493	RESIDUAL	58.	.27354	.00472		
STD DEVIATION	.06867	COEFF OF VARIABILITY	6.0 PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F	SIGNIFICANCE	BETA	ELASTICITY
OPCHAR	1.2854872	.50991007E-01	635.54797	0	.9572732	1.25480
(CONSTANT)	-.29265023	.57035994E-01	25.603619	.000		

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F	SIGNIFICANC
DERSS	-.22046	.41493	2.9118940	.093
MISREQ	-.00865	.77511	.42615486	.940

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VARIABLE(S) ENTERED ON STEP NUMBER 2.. DERSS DESIGN REQMT+SPEC STANDARDS

MULTIPLE R	.95939	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SOUAFE	F	SIGNIFIC
R SQUARE	.92044	REGRESSION	2.	3.01065	1.50533	329.70494	0
ADJUSTED R SQUARE	.91764	RESIDUAL	57.	.26024	.00457		
STD DEVIATION	.06757	COEFF OF VARIABILITY	5.9 PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F	SIGNIFICANCE	BETA	ELASTICITY
OPCHAR	1.3871483	.77886713E-01	317.18968	0	1.0329780	1.35413
DERSS	-.57919916E-01	.22221818E-01	2.9118940		-.0989736	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F	SIGNIFICANC
MISREQ	.42075	.16175	12.005947	.001

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FILE   HARD     (CREATION DATE =  31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..     INTERFAC    INTERFACE REQMTS

VARIABLE(S) ENTERED ON STEP NUMBER   3..   MISREQ     MISSION REQUIREMENTS

MULTIPLE R           .96671        ANALYSIS OF VARIANCE     DF      SUM OF SQUARES       MEAN SQUARE          F      SIGNIFI
R SQUARE             .93452        REGRESSION                3.          3.05672           1.01891         266.41396      0
ADJUSTED R SQUARE    .93101        RESIDUAL                 56.           .21417            .00382
STD DEVIATION        .06184        COEFF OF VARIABILITY      5.4 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE           B          STD ERROR B        F            BETA              VARIABLE      PARTIAL    TOLERANCE        F
                                            ------------  ----------                                              ----------
                                            SIGNIFICANCE  ELASTICITY                                              SIGNIFICAN

OPCHAR        1.5677667     .88259852E-01   315.52698     1.1674804
                                                    0      1.53044
DERSS         -.17538342    .445233300E-01   15.516786    -.4577628
                                                 .000       -.19292
MISREQ        2.0691951     .59618490        12.045947     .2950940
                                                 .001      1.01569
(CONSTANT)    -2.4722434    .61221103        16.307228
                                                 .000

ALL VARIABLES ARE IN THE EQUATION.


COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE          B           STD ERROR B        T              95.0 PCT CONFIDENCE INTERVAL

OPCHAR        1.5677667     .882598521-01   17.763079      1.3909610    ,  1.7445725
DERSS         -.17538342    .445233300E-01  -3.9391351     -.26457436   , -.861924666E-01
MISREQ        2.0691951     .59618490        3.4707271      .87489323   ,  3.2634970
CONSTANT      -2.4722434    .61221103       -4.0382209    -3.6986494    , -1.2458373

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

DERSS          .00198
MISREQ        -.02361     .35544
OPCHAR        -.00317     .03103     .00779
```

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0	
1.	1.000000	.9893351	.1066494E-01		I	
2.	1.000000	.9893351	.1066494E-01		I	
3.	1.000000	.9893351	.1066494E-01		I	
4.	1.000000	.9893351	.1066494E-01		I	
5.	1.000000	.9893351	.1066494E-01		I	
6.	1.000000	.9893351	.1066494E-01		I	
7.	1.050000	1.055447	-.5446559E-02		I	
8.	1.000000	.9893351	.1066494E-01		I	
9.	1.000000	.9893351	.1066494E-01		I	
10.	1.000000	.9893351	.1066494E-01		I	
11.	1.000000	.9893351	.1066494E-01		I	
12.	1.000000	.9893351	.1066494E-01		I	
13.	1.000000	.9893351	.1066494E-01		I	
14.	1.300000	1.309476	-.9476384E-02		I	
15.	1.030000	1.025845	.4154941E-02		I	
16.	1.000000	.9893351	.1066494E-01		I	
17.	1.000000	.9893351	.1066494E-01		I	
18.	1.000000	.9893351	.1066494E-01		I	
19.	1.000000	.9893351	.1066494E-01		I	
20.	1.000000	.9893351	.1066494E-01		I	
21.	1.310000	1.548728	-.2387277	R	I	
22.	1.300000	1.309476	-.9476384E-02		I	
23.	1.030000	1.025845	.4154941E-02		I	
24.	1.000000	.9893351	.1066494E-01		I	
25.	1.000000	.9893351	.1066494E-01		I	
26.	1.000000	.9893351	.1066494E-01		I	
27.	1.000000	.9893351	.1066494E-01		I	
28.	1.680000	1.666483	.1351700E-01		I	
29.	1.300000	1.309476	-.9476384E-02		I	
30.	1.030000	1.025845	.4154941E-02		I	
31.	1.000000	.9893351	.1066494E-01		I	
32.	1.000000	.9893351	.1066494E-01		I	
33.	1.000000	.9893351	.1066494E-01		I	
34.	1.420000	1.461780	-.4177982E-01		I	
35.	1.000000	.9893351	.1066494E-01		I	
36.	1.000000	.9893351	.1066494E-01		I	
37.	1.030000	1.025845	.4154941E-02		I	
38.	1.300000	1.309476	-.9476384E-02		I	
39.	1.680000	1.666483	.1351700E-01		I	
40.	1.780000	1.498828	.2811720		I	R
41.	1.030000	1.018830	.1117028E-01		I	
42.	1.030000	1.025845	.4154941E-02		I	
43.	1.300000	1.309476	-.9476384E-02		I	
44.	1.000000	.9893351	.1066494E-01		I	
45.	1.050000	1.163330	-.1133296		I	
46.	1.300000	1.309476	-.9476384E-02		I	
47.	1.000000	.9893351	.1066494E-01		I	
48.	1.580000	1.610696	-.3069685E-01		I	
49.	1.050000	1.163330	-.1133296		I	
50.	1.000000	.9893351	.1066494E-01		I	

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL
53.	1.580000	1.610696	-.3064605E-01
54.	2.070000	1.960282	.1097180
55.	1.270000	1.276688	-.6687735E-02
56.	1.050000	1.163330	-.1133296
57.	1.260000	1.203027	.5697330E-01
58.	1.270000	1.276688	-.6687735E-02
59.	1.260000	1.203027	.5697330E-01
60.	1.230000	1.225613	.4387135E-02

-250 0.0

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 60.
NUMBER OF 2 S.D. OUTLIERS 2. OR 3.33 PERCENT OF THE TOTAL

VON NEUMANN RATIO 2.00295 DURBIN-WATSON TEST 1.96957

NUMBER OF POSITIVE RESIDUALS 42.
NUMBER OF NEGATIVE RESIDUALS 18.
NUMBER OF RUNS OF SIGNS 25.

EXPECTED NUMBER OF RUNS OF SIGNS 26.
EXPECTED S.D. OF RUN DISTRIBUTION 3.21581
UNIT NORMAL DEVIATE-
Z=(EXPECTED-OBSERVED)/S.D. -.21773
PROBABILITY OF OBTAINING .GE. ABS(Z) .41382

APPENDIX TEN

COMPUTER RUN WITH 60 TRANSFORMED DATA POINTS AND TIME ADDED AS AN INDEPENDENT VARIABLE

MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS 18 SEP 78 PAGE 2

FILE HARD (CREATION DATE = 18 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

VARIABLE	MEAN	STANDARD DEV	CASES
MISREQ	1.0075	.0336	60
OPCHAR	1.1208	.1753	60
DERSS	1.2630	.6146	60
INTERFAC	1.1482	.2355	60
TIME	13.1333	7.7229	60

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

	MISREQ	OPCHAR	DERSS	INTERFAC
OPCHAR	.47428			
DERSS	.06721	.76498		
INTERFAC	.45174	.95727	.69115	
TIME	.01430	.34225	.14226	.34684

238

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MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS                                      18 SEP 78     PAGE    3

FILE   HARD     (CREATION DATE =  18 SEP 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..     MISREQ     MISSION REQUIREMENTS

MEAN RESPONSE          1.00750      STD. DEV.         .03358

VARIABLE(S) ENTERED ON STEP NUMBER   1..    TIME        TIME FROM SPEC START

MULTIPLE R               .01438         ANALYSIS OF VARIANCE     DF      SUM OF SQUARES        MEAN SQUARE          F      SIGNIFI
R SQUARE                 .00021         REGRESSION                1.              .00001            .00001         .01199    .913
ADJUSTED R SQUARE      -.01703          RESIDUAL                 58.              .06651            .00115
STD DEVIATION            .03386         COEFF OF VARIABILITY      3.4 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION ------

VARIABLE            B           STD ERROR B          F           BETA           VARIABLE      PARTIAL    TOLERANCE        F
                                                ------------  ----------                                               -----------
                                                SIGNIFICANCE  ELASTICITY                                               SIGNIFICANC

TIME          .62518945E-04   .57085791E-03   .11994088E-01   .0143789
                                                  .913          .00081
(CONSTANT)    1.0066789       .86787927E-02   13454.360
                                                  .000

ALL VARIABLES ARE IN THE EQUATION.


COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE            B          STD ERROR B           T              95.0 PCT CONFIDENCE INTERVAL

TIME          .62518945E-04   .57085791E-03   .10951752            -.10881773E-02,   .12052152E-02
CONSTANT      1.0066789       .86787927E-02   115.99297             .98930643    ,   1.0240514

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME          .00000

                 TIME
```

```
MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS
                                                                                     18 SEP 78          PAGE     5
FILE    WARD      (CREATION DATE =  18 SEP 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E    R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..    OPCHAR      OPERATIONAL CHARACTERISTICS

MEAN RESPONSE          1.12083       STD. DEV.        .17534

VARIABLE(S) ENTERED ON STEP NUMBER   1..   TIME        TIME FROM SPEC START

MULTIPLE R             .34225        ANALYSIS OF VARIANCE     DF      SUM OF SQUARES      MEAN SQUARE          F       SIGNIFI
R SQUARE               .11714        REGRESSION               1.            .21247           .21247       7.69524     O
ADJUSTED R SQUARE      .10191        RESIDUAL                58.           1.60139           .02761
STD DEVIATION          .16616        COEFF OF VARIABILITY    14.8 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------      ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE          B            STD ERROR B          F            BETA        VARIABLE     PARTIAL    TOLERANCE        F
                                               ------------  ----------                                          ------------
                                               SIGNIFICANCE  ELASTICITY                                          SIGNIFICANC

TIME         .77783471E-02   .28811837E-02    7.6952449      .3422586
                                                   .007
(CONSTANT)   1.0187828       .42585376E-01   572.32434       .09105
                                                   0

ALL VARIABLES ARE IN THE EQUATION.


COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE         B            STD ERROR B          T                95.0 PCT CONFIDENCE INTERVAL

TIME        .77783471E-02   .28811837E-02   2.7748388            .21633287E-02,   .13377365E-01
CONSTANT    1.0187828       .42585376E-01   23.923301            .93353888    ,   1.1040267

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME        .00001

               TIME
```

```
MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS                                    18 SEP 78    PAGE   7

FILE   WAND     (CREATION DATE =  18 SEP 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E    R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..    DERSS      DESIGN REQMT*SPEC STANDARDS

MEAN RESPONSE         1.26300      STD. DEV.         .61455

VARIABLE(S) ENTERED ON STEP NUMBER   1..   TIME        TIME FROM SPEC START


MULTIPLE R             .14226        ANALYSIS OF VARIANCE    DF       SUM OF SQUARES       MEAN SQUARE          F      SIGNIFI
R SQUARE               .02024        REGRESSION               1.              .45096            .45096       1.19806    .3
ADJUSTED R SQUARE      .00335        RESIDUAL                58.            21.83190            .37641
STD DEVIATION          .61352        COEFF OF VARIABILITY    48.6 PCT


-------------------- VARIABLES IN THE EQUATION ---------------------        ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE            B            STD ERROR B        F             BETA          VARIABLE     PARTIAL    TOLERANCE        F
                                               ------------   ----------                                           -----------
                                               SIGNIFICANCE   ELASTICITY                                           SIGNIFICANC

TIME          .11320476E-01   .10342517E-01   1.1980554      .1422606
                                                    .278       .11772
(CONSTANT)    1.1143244       .15723800       58.223649
                                                    .000

ALL VARIABLES ARE IN THE EQUATION.


COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE          B           STD ERROR B          T              95.0 PCT CONFIDENCE INTERVAL

TIME          .11320476E-01   .10342517E-01   1.0945572         -.93023205E-02,  .32023272E-01
CONSTANT      1.1143244       .15723800       7.0868645          .79957836    ,  1.4290705

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME          .00011
                 TIME
```

FILE WARD (CREATION DATE = 18 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. INTERFAC INTERFACE REQMTS

MEAN RESPONSE 1.14817 STD. DEV. .23545

VARIABLE(S) ENTERED ON STEP NUMBER 1.. TIME TIME FROM SPEC START

MULTIPLE R	.34604	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.11974	REGRESSION	1.	.39166	.39166	7.88978	0
ADJUSTED R SQUARE	.10457	RESIDUAL	58.	2.87923	.04964		
STD DEVIATION	.22280	COEFF OF VARIABILITY	19.4 PCT				

---------- VARIABLES IN THE EQUATION ----------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
TIME	.10549977E-01	.37559427E-02	7.8897842 / .007	.3460378 / .12868
(CONSTANT)	1.0096103	.57181868E-01	312.61308 / 0	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICAN

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
TIME	.10549977E-01	.37559427E-02	2.8088760	.38316418E-02, .18068314E-01
CONSTANT	1.0096103	.57181860E-01	17.688865	.89530851 , 1.1239121

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME	.00001
	TIME

FILE WARD (CREATION DATE = 18 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. MISREQ MISSION REQUIREMENTS

MEAN RESPONSE 1.00750 STD. DEV. .03358

VARIABLE(S) ENTERED ON STEP NUMBER 1.. DERSS DESIGN REQMT*SPEC STANDARDS

MULTIPLE R	.86721	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.75205	REGRESSION	1.	.05003	.05003	175.92126	0
ADJUSTED R SQUARE	.74778	RESIDUAL	58.	.01649	.00028		
STD DEVIATION	.01686	COEFF OF VARIABILITY	1.7 PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
DERSS	.47303953E-01	.35724991E-02	175.92126	.8672101
			0	.05948
(CONSTANT)	.94765407	.50098488E-02	35780.830	
			0	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
OPCHAR	-.58963	.41493	30.377960
			.000
INTERFAC	-.41023	.52231	11.533626
			.001
TIME	-.22113	.97976	2.9305603
			.092

* *

VARIABLE(S) ENTERED ON STEP NUMBER 2.. OPCHAR OPERATIONAL CHARACTERISTICS

MULTIPLE R	.91556	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.83825	REGRESSION	2.	.05576	.02788	147.70313	0
ADJUSTED R SQUARE	.83258	RESIDUAL	57.	.01076	.00019		
STD DEVIATION	.01374	COEFF OF VARIABILITY	1.4 PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
DERSS	.66433319E-01	.45185333E-02	216.16079	1.2158471
			0	.08328
OPCHAR	-.87289212E-01	.15837305E-01	30.377960	-.4557953

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
INTERFAC	.42075	.07956	12.005947
			.001
TIME	-.00700	.04843	.27419686

FILE WARD (CREATION DATE = 18 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. MISREQ MISSION REQUIREMENTS

VARIABLE(S) ENTERED ON STEP NUMBER 3.. INTERFAC INTERFACE REQMTS

MULTIPLE R	.93107	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.86689	REGRESSION	3.	.05767	.01922	121.56618	0
ADJUSTED R SQUARE	.85976	RESIDUAL	56.	.00886	.00016		
STD DEVIATION	.01257	COEFF OF VARIABILITY	1.2 PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
DERSS	.69677496E-01	.42398733E-02	278.07185 / .000	1.2752213 / .08735
OPCHAR	-.20596446	.37138644E-01	30.756186 / .000	-1.0754780 / -.22913
INTERFAC	.85553393E-01	.24649991E-01	12.045947 / .001	.5998992 / .09750
(CONSTANT)	1.0521196	.15563725E-01	4569.8627 / 0	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
TIME	-.01947	.04789	.20849171 / .886

MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS 18 SEP 78 PAGE 13

FILE WARD (CREATION DATE = 18 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. MISREQ MISSION REQUIREMENTS

VARIABLE(S) ENTERED ON STEP NUMBER 4.. TIME TIME FROM SPEC START

MULTIPLE R	.93118	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.86694	REGRESSION	4.	.05767	.01442	89.58568	0
ADJUSTED R SQUARE	.85726	RESIDUAL	55.	.00885	.00016		
STD DEVIATION	.01269	COEFF OF VARIABILITY	1.3 PCT				

--------------------- VARIABLES IN THE EQUATION ---------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
DERSS	.69559547E-01	.43547336E-02	255.14691	1.2730626
			0	.08720
OPCHAR	-.20525965	.37784263E-01	29.511898	-1.0717977
			.000	-.22835
INTERFAC	.85644368E-01	.24876339E-01	11.852981	.6005372
			.001	.09760
TIME	-.33535644E-04	.23225358E-03	.20849171E-01	-.0077129
			.886	-.00044
(CONSTANT)	1.0518146	.15843863E-01	4407.5785	
			0	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
DERSS	.69559547E-01	.43547336E-02	15.973319	.60832466E-01, .78286629E-01
OPCHAR	-.20525965	.37784263E-01	-5.4324111	-.28098101 , -.12953829
INTERFAC	.85644368E-01	.24876339E-01	3.4428043	.35791069E-01, .13549767
TIME	-.33535644E-04	.23225358E-03	-.14439242	-.49898206E-03, .43191077E-03
CONSTANT	1.0518146	.15843863E-01	66.389596	1.0200644 , 1.0835648

FILE WARD (CREATION DATE = 18 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. MISREQ MISSION REQUIREMENTS

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

OPCHAR	.00143			
DERSS	-.00008	.00002		
INTERFAC	-.00085	.00002	.00062	
TIME	-.00000	.00000	-.00000	.00000
	OPCHAR	DERSS	INTERFAC	TIME

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL
1.	1.000000	1.001759	-.1758841E-02
2.	1.000000	1.001759	-.1758841E-02
3.	1.000000	1.001759	-.1758841E-02
4.	1.000000	1.001759	-.1758841E-02
5.	1.000000	1.001759	-.1758841E-02
6.	1.000000	1.001759	-.1758841E-02
7.	1.000000	1.000513	-.5131027E-03
8.	1.000000	1.001625	-.1624697E-02
9.	1.000000	1.001591	-.1591163E-02
10.	1.000000	1.001524	-.1524092E-02
11.	1.000000	1.001323	-.1322878E-02
12.	1.000000	1.001289	-.1289342E-02
13.	1.000000	1.001256	-.1255806E-02
14.	1.000000	1.000281	-.2812123E-03
15.	1.000000	1.002176	-.2176277E-02
16.	1.000000	1.001591	-.1591163E-02
17.	1.000000	1.001524	-.1524092E-02
18.	1.000000	1.001323	-.1322878E-02
19.	1.000000	1.001323	-.1322878E-02
20.	1.000000	1.001256	-.1255806E-02
21.	1.000000	1.014480	-.1448024E-01
22.	1.000000	1.000214	-.2141410E-03
23.	1.000000	1.002109	-.2109206E-02
24.	1.000000	1.001524	-.1524092E-02
25.	1.000000	1.001323	-.1322878E-02
26.	1.000000	1.001289	-.1289342E-02
27.	1.000000	1.001256	-.1255806E-02
28.	1.170000	1.167936	.2064020E-02
29.	1.000000	1.000013	-.1292715E-04
30.	1.000000	1.001908	-.1907992E-02
31.	1.000000	1.001323	-.1322878E-02
32.	1.000000	1.001289	-.1289342E-02
33.	1.000000	1.001256	-.1255806E-02
34.	1.110000	1.035960	.7404044E-01
35.	1.000000	1.001289	-.1289342E-02
36.	1.000000	1.001256	-.1255806E-02
37.	1.000000	1.001874	-.1874456E-02
38.	1.000000	.9999794	.2060850E-04
39.	1.170000	1.167902	.2097555E-02
40.	1.000000	1.036767	-.3676721E-01
41.	1.000000	1.004623	-.4623303E-02
42.	1.000000	1.001841	-.1840921E-02
43.	1.000000	.9999459	.5414410E-04
44.	1.000000	1.001256	-.1255806E-02
45.	1.000000	.9906459	.9354142E-02
46.	1.000000	.9999123	.8767979E-04
47.	1.000000	1.001222	-.1222271E-02
48.	1.000000	.9910842	.8115791E-02
49.	1.000000	.9906123	.9387678E-02
50.	1.000000	1.001189	-.1188735E-02

MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS 18 SEP 78 PAGE 17

FILE WARD (CREATION DATE = 18 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0
53.	1.000000	.9917501	.8249930E-02		I
54.	1.000000	1.007477	-.7477175E-02		I
55.	1.000000	.9893193	.1068072E-01		I
56.	1.000000	.9904446	.9555356E-02		I
57.	1.000000	1.017443	-.1744309E-01		I
58.	1.000000	.9890845	.1091547E-01		I
59.	1.000000	1.017342	-.1734249E-01		I
60.	1.000000	1.014079	-.1407887E-01		I

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 60.
NUMBER OF 2 S.D. OUTLIERS 2. OR 3.33 PERCENT OF THE TOTAL

VON NEUMANN RATIO 2.04299 DURBIN-WATSON TEST 2.00894

NUMBER OF POSITIVE RESIDUALS 15.
NUMBER OF NEGATIVE RESIDUALS 45.
NUMBER OF RUNS OF SIGNS 19.

EXPECTED NUMBER OF RUNS OF SIGNS 23.
EXPECTED S.D. OF RUN DISTRIBUTION 2.86342
UNIT NORMAL DEVIATE-
Z=(EXPECTED-OBSERVED)/S.D. -1.39693
PROBABILITY OF OBTAINING .GE. ABS(Z) .08122

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE..   OPCHAR   OPERATIONAL CHARACTERISTICS

MEAN RESPONSE   1.12083   STD. DEV.   .17534

VARIABLE(S) ENTERED ON STEP NUMBER 1..   INTERFAC   INTERFACE REQMTS

MULTIPLE R	.95727	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.91637	REGRESSION	1.	1.66217	1.66217	635.54797	0
ADJUSTED R SQUARE	.91493	RESIDUAL	58.	.15169	.00262		
STD DEVIATION	.05114	COEFF OF VARIABILITY	4.6 PCT				

------------------ VARIABLES IN THE EQUATION ------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
INTERFAC	.71285972	.28276777E-01	635.54797 0	.9572732 .73024
(CONSTANT)	.30235157	.33130944E-01	83.283891 .000	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
MISREQ	.16188	.79593	1.5338614 .221
DERSS	.49417	.52231	18.416769 .000
TIME	.04053	.08026	.93809948 .761

* *

VARIABLE(S) ENTERED ON STEP NUMBER 2..   DERSS   DESIGN REQMT*SPEC STANDARDS

MULTIPLE R	.96788	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFIC
R SQUARE	.93679	REGRESSION	2.	1.69921	.84961	422.40644	0
ADJUSTED R SQUARE	.93458	RESIDUAL	57.	.11465	.00201		
STD DEVIATION	.04485	COEFF OF VARIABILITY	4.0 PCT				

------------------ VARIABLES IN THE EQUATION ------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
INTERFAC	.61108883	.34311980E-01	317.18968 0	.82068888 .62599
DERSS	.56415650E-01	.13145977E-01	18.416769	.1977349

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
MISREQ	-.59541	.20622	30.756186 .000
TIME	.12919	.06228	.95044407

FILE WARD (CREATION DATE = 18 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. OPCHAR OPERATIONAL CHARACTERISTICS

VARIABLE(S) ENTERED ON STEP NUMBER 3.. MISREQ MISSION REQUIREMENTS

MULTIPLE R	.97939	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.95920	REGRESSION	3.	1.73986	.57995	438.86468	0
ADJUSTED R SQUARE	.95702	RESIDUAL	56.	.07400	.00132		
STD DEVIATION	.03635	COEFF OF VARIABILITY	3.2 PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
INTERFAC	.54170731	.38496251E-01	315.52698 / 0	.7274389 / .55492
DERSS	.15634680	.20934821E-01	55.779252 / .000	.5479982 / .17618
MISREQ	-1.7212333	.31036555	30.756186 / .000	-.3296329 / -1.54719
(CONSTANT)	2.0355396	.30533076	44.444497 / .000	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANCE
TIME	.09269	.85491	.47666012 / .493

MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS

FILE WARD (CREATION DATE = 18 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. OPCHAR OPERATIONAL CHARACTERISTICS

VARIABLE(S) ENTERED ON STEP NUMBER 4.. TIME TIME FROM SPEC START

MULTIPLE R	.97957	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.95955	REGRESSION	4.	1.74849	.43512	326.19165	0
ADJUSTED R SQUARE	.95661	RESIDUAL	55.	.07337	.00133		
STD DEVIATION	.03652	COEFF OF VARIABILITY	3.3 PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
INTERFAC	.53536124	.31988785E-01	280.09848 / 0	.7189170 / .54842
DERSS	.15625844	.21032918E-01	55.193494 / 0	.5476805 / .17608
MISREQ	-1.7012493	.31316653	29.511098 / .000	-.3258057 / -1.52923
TIME	.45973859E-03	.66589864E-03	.47666812 / .493	.0202495 / .00539
(CONSTANT)	2.0167658	.38797835	82.883787 / 0	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
INTERFAC	.53536124	.31988785E-01	16.735984	.47125428 , .59946820
DERSS	.15625844	.21032918E-01	7.4292324	.11410753 , .19840935
MISREQ	-1.7012493	.31316653	-5.4324111	-2.3288491 , -1.0736496
TIME	.45973859E-03	.66589864E-03	.69041156	-.87473608E-03, .17942133E-02
CONSTANT	2.0167658	.38797835	6.5985714	1.3995794 , 2.6339522

FILE WARD (CREATION DATE = 15 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. OPCHAR OPERATIONAL CHARACTERISTICS

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

MISREQ	.09807			
DERSS	-.00565	.00044		
INTERFAC	.00365	-.00043	.00102	
TIME	.00002	-.00000	-.00001	.00000
	MISREQ	DERSS	INTERFAC	TIME

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OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0	
1.	1.000000	1.007136	-.7136143E-02			
2.	1.000000	1.007136	-.7136143E-02			
3.	1.000000	1.007136	-.7136143E-02			
4.	1.000000	1.007136	-.7136143E-02			
5.	1.000000	1.007136	-.7136143E-02			
6.	1.000000	1.007136	-.7136143E-02			
7.	1.050000	1.046681	.3318749E-02			
8.	1.000000	1.008975	-.8975098E-02			
9.	1.000000	1.009435	-.9434836E-02			
10.	1.000000	1.010354	-.1035431E-01			
11.	1.000000	1.013113	-.1311275E-01			
12.	1.000000	1.013572	-.1357248E-01			
13.	1.000000	1.014032	-.1403222E-01			
14.	1.240000	1.220046	.1995409E-01			
15.	1.030000	1.034871	-.4871180E-02			
16.	1.000000	1.009435	-.9434836E-02			
17.	1.000000	1.010354	-.1035431E-01			
18.	1.000000	1.013113	-.1311275E-01			
19.	1.000000	1.013113	-.1311275E-01			
20.	1.000000	1.014032	-.1403222E-01			
21.	1.500000	1.376327	.1236729			R
22.	1.240000	1.220965	.1903461E-01			
23.	1.030000	1.035791	-.5790657E-02			
24.	1.000000	1.010354	-.1035431E-01			
25.	1.000000	1.013113	-.1311275E-01			
26.	1.000000	1.013572	-.1357248E-01			
27.	1.000000	1.014032	-.1403222E-01			
28.	1.570000	1.594223	-.2422334E-01			
29.	1.240000	1.223724	.1627610E-01			
30.	1.030000	1.038549	-.8549089E-02			
31.	1.000000	1.013113	-.1311275E-01			
32.	1.000000	1.013572	-.1357248E-01			
33.	1.000000	1.014032	-.1403222E-01			
34.	1.230000	1.154417	.7558265E-01			R
35.	1.000000	1.013572	-.1357248E-01			
36.	1.000000	1.014032	-.1403222E-01			
37.	1.030000	1.039009	-.9008827E-02			
38.	1.240000	1.224184	.1581644E-01			
39.	1.570000	1.594683	-.2468308E-01			
40.	1.410000	1.550370	-.1403704	R		
41.	1.030000	1.045719	-.1571898E-01			
42.	1.030000	1.039469	-.9468566E-02			
43.	1.240000	1.224643	.1535671E-01			
44.	1.000000	1.014032	-.1403222E-01			
45.	1.130000	1.067824	.6217604E-01			
46.	1.240000	1.225103	.1489697E-01			
47.	1.000000	1.014492	-.1449196E-01			
48.	1.450000	1.400465	.4953473E-01			
49.	1.130000	1.068284	.6171630E-01			
50.	1.000000	1.014952	-.1495178E-01			

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FILE   HARD     (CREATION DATE =  18 SEP 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * *

OBSERVATION     Y VALUE        Y ESTIMATE       RESIDUAL        -2SD                       0.0

    53.         1.450000        1.402304        .4769578E-01                                I
    54.         1.720000        1.730720       -.1071951E-01                                I
    55.         1.190000        1.171173        .1882657E-01                                I
    56.         1.130000        1.070582        .5941761E-01                                I
    57.         1.190000        1.234667       -.4466659E-01                                I
    58.         1.190000        1.174392        .1560840E-01                                I
    59.         1.190000        1.236046       -.4604575E-01                                I
    60.         1.210000        1.228717       -.1871731E-01                                I

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
       R INDICATES POINT OUT OF RANGE OF PLOT


NUMBER OF CASES PLOTTED          60.
NUMBER OF 2 S.D. OUTLIERS         3. OR   5.00 PERCENT OF THE TOTAL

VON NEUMANN RATIO     1.81189          DURBIN-WATSON TEST    1.78091

NUMBER OF POSITIVE RESIDUALS      18.
NUMBER OF NEGATIVE RESIDUALS      42.
NUMBER OF RUNS OF SIGNS           25.

EXPECTED NUMBER OF RUNS OF SIGNS            26.
EXPECTED S.D. OF RUN DISTRIBUTION      3.21501
UNIT NORMAL DEVIATE-
  Z=(EXPECTED-OBSERVED)/S.D.          -.21773
PROBABILITY OF OBTAINING .GE. ABS(Z)   .41382
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255

254

DEPENDENT VARIABLE.. DERSS DESIGN REQMT*SPEC STANDARDS

MEAN RESPONSE 1.26340 STD. DEV. .61455

VARIABLE(S) ENTERED ON STEP NUMBER 1.. MISREQ MISSION REQUIREMENTS

MULTIPLE R	.86721	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.75205	REGRESSION	1.	16.75790	16.75790	175.92126	0
ADJUSTED R SQUARE	.74778	RESIDUAL	58.	5.52496	.09526		
STD DEVIATION	.30864	COEFF OF VARIABILITY	24.4 PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
MISREQ	15.871477	1.1966253	175.92126 0	.8672101 12.66074
(CONSTANT)	-14.727513	1.2062582	149.06588 0	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
OPCHAR	.80672	.77513	106.23049 0
INTERFAC	.67395	.79593	47.435483 0
TIME	.26068	.99979	4.1558469 .046

* *

VARIABLE(S) ENTERED ON STEP NUMBER 2.. OPCHAR OPERATIONAL CHARACTERISTICS

MULTIPLE R	.95573	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFIC
R SQUARE	.91342	REGRESSION	2.	20.35355	10.17677	300.66451	0
ADJUSTED R SQUARE	.91038	RESIDUAL	57.	1.92931	.03385		
STD DEVIATION	.18398	COEFF OF VARIABILITY	14.6 PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
MISREQ	11.911669	.81018498	216.16879 0	.6508480 9.50198
OPCHAR	1.5991079	.15515826	106.23049 0	.4562635 1.41918
(CONSTANT)	-12.530429	.74997360	279.15144	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
INTERFAC	-.46580	.08362	15.516786 .000
TIME	-.08549	.05464	.41225580 .523

FILE WARD (CREATION DATE = 18 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. DERSS DESIGN REQMT*SPEC STANDARDS

VARIABLE(S) ENTERED ON STEP NUMBER 3.. INTERFAC INTERFACE REQMTS

MULTIPLE R	.96551	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.93220	REGRESSION	3.	20.77214	6.92405	256.66418	0
ADJUSTED R SQUARE	.92857	RESIDUAL	56.	1.51072	.02698		
STD DEVIATION	.16425	COEFF OF VARIABILITY	13.0 PCT				

------------------ VARIABLES IN THE EQUATION ------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
MISREQ	11.087033	.72332557	278.07185 .000	.6495019 9.48233
OPCHAR	3.1917030	.42735239	55.779252 .000	.9106232 2.83244
INTERFAC	-1.2371013	.31405403	15.516786 .000	-.4739727 -1.12462
(CONSTANT)	-12.870155	.67507615	363.46450 0	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
TIME	-.06132	.05077	.20759962 .650

FILE WARD (CREATION DATE = 18 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. DERSS DESIGN REQMT*SPEC STANDARDS

VARIABLE(S) ENTERED ON STEP NUMBER 4.. TIME TIME FROM SPEC START

MULTIPLE R	.96564	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFIC
R SQUARE	.93246	REGRESSION	4.	20.77782	5.19446	189.82619	0
ADJUSTED R SQUARE	.92755	RESIDUAL	55.	1.50504	.02736		
STD DEVIATION	.16542	COEFF OF VARIABILITY	13.1 PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
MISREQ	11.826769	.74840775	255.14691 / 0	.6462091 / 9.43426
OPCHAR	3.2054459	.43146395	55.193494 / 0	.9145441 / 2.88463
INTERFAC	-1.2273888	.31781849	14.989581 / .000	-.4782485 / -1.11579
TIME	-.13775889E-02	.30232994E-02	.20759962 / .650	-.0173107 / -.01432
(CONSTANT)	-12.817911	.68950434	345.58947 / 0	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE		STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
MISREQ	11 .26763	.74840775	15.973319	10.342958	13.310579
OPCHAR	3.2054459	.43146395	7.4292324	2.3407720	4.0701190
INTERFAC	-1.2273888	.31781849	-3.8716380	-1.8627801	-.59206156
TIME	-.13775889E-02	.30232994E-02	-.45563181	-.74363363E-02	.46813184E-02
CONSTANT	-12.817911	.68950434	-18.590037	-14.199789	-11.436114

FILE WARD (CREATION DATE = 18 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. DERSS DESIGN REQMT*SPEC STANDARDS

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

	MISREQ	OPCHAR	INTERFAC	TIME
MISREQ	.54820			
OPCHAR	-.05475	.18616		
INTERFAC	-.00083	-.12814	.10050	
TIME	.00040	-.00009	-.00006	.00001

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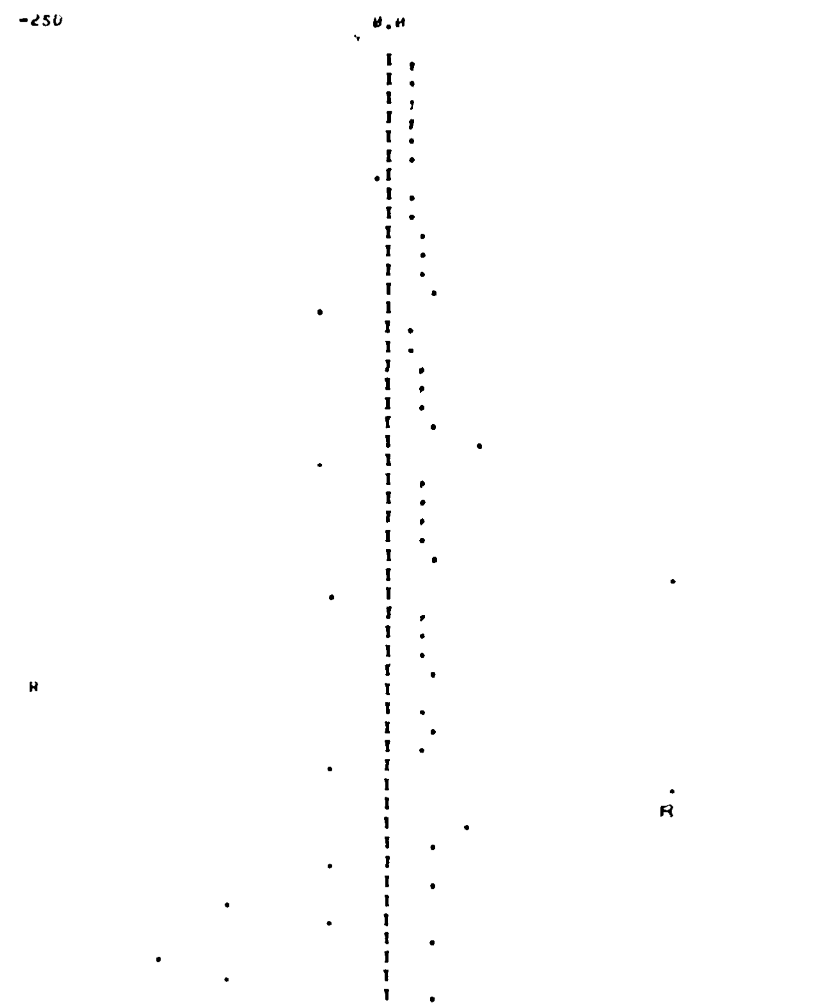
OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL
1.	1.000000	.9869227	.1307727E-01
2.	1.000000	.9869227	.1307727E-01
3.	1.000000	.9869227	.1307727E-01
4.	1.000000	.9869227	.1307727E-01
5.	1.000000	.9869227	.1307727E-01
6.	1.000000	.9869227	.1307727E-01
7.	1.070000	1.088316	-.1831595E-01
8.	1.000000	.9814127	.1858731E-01
9.	1.000000	.9800352	.1996482E-01
10.	1.000000	.9772802	.2271984E-01
11.	1.000000	.9690151	.3098489E-01
12.	1.000000	.9676376	.3236240E-01
13.	1.000000	.9662601	.3373991E-01
14.	1.320000	1.381128	-.6112796E-01
15.	1.060000	1.039377	.2062287E-01
16.	1.000000	.9800352	.1996482E-01
17.	1.000000	.9772802	.2271984E-01
18.	1.000000	.9690151	.3098489E-01
19.	1.000000	.9690151	.3098489E-01
20.	1.000000	.9662601	.3373991E-01
21.	2.280000	2.199515	.8048493E-01
22.	1.320000	1.378373	-.5837294E-01
23.	1.060000	1.036622	.2337788E-01
24.	1.000000	.9772802	.2271984E-01
25.	1.000000	.9690151	.3098489E-01
26.	1.000000	.9676376	.3236240E-01
27.	1.000000	.9662601	.3373991E-01
28.	4.240000	3.972051	.2679490
29.	1.320000	1.370188	-.5018789E-01
30.	1.060000	1.028357	.3164294E-01
31.	1.000000	.9690151	.3098489E-01
32.	1.000000	.9676376	.3236240E-01
33.	1.000000	.9662601	.3373991E-01
34.	1.660000	2.490335	-.8303348
35.	1.000000	.9676376	.3236240E-01
36.	1.000000	.9662601	.3373991E-01
37.	1.060000	1.026980	.3302045E-01
38.	1.320000	1.368730	-.4873038E-01
39.	4.240000	3.970674	.2693265
40.	1.760000	1.323136	.4368641
41.	1.100000	1.025602	.7439796E-01
42.	1.060000	1.025602	.3439796E-01
43.	1.320000	1.367353	-.4735287E-01
44.	1.000000	.9662601	.3373991E-01
45.	1.170000	1.320222	-.1502215
46.	1.320000	1.365975	-.4597536E-01
47.	1.000000	.9648826	.3511742E-01
48.	1.480000	1.690075	-.2100749
49.	1.170000	1.318844	-.1488440
50.	1.000000	.9635051	.3649493E-01



FILE WAHD (CREATION DATE = 18 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0
53.	1.480000	1.680565	-.2085648		I
54.	1.900000	1.951241	-.5124113E-01		I
55.	1.060000	1.234259	-.1742594		I
56.	1.170000	1.311956	-.1419565		I
57.	1.480000	1.236891	.2431093		I
58.	1.060000	1.224617	-.1646169		I
59.	1.480000	1.232758	.2472418		I
60.	1.530000	1.330933	.1990665		I

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 60.
NUMBER OF 2 S.D. OUTLIERS 2. OR 3.33 PERCENT OF THE TOTAL

VON NEUMANN RATIO 1.83172 DURBIN-WATSON TEST 1.80119

NUMBER OF POSITIVE RESIDUALS 42.
NUMBER OF NEGATIVE RESIDUALS 18.
NUMBER OF RUNS OF SIGNS 23.

EXPECTED NUMBER OF RUNS OF SIGNS 26.
EXPECTED S.D. OF RUN DISTRIBUTION 3.21581
UNIT NORMAL DEVIATE-
Z=(EXPECTED-OBSERVED)/S.D. -.83981
PROBABILITY OF OBTAINING .GE. ABS(Z) .20051

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE..   INTERFAC   INTERFALE REQMTS

MEAN RESPONSE   1.14817   STD. DEV.   .23595

VARIABLE(S) ENTERED ON STEP NUMBER 1..   OPCHAR   OPERATIONAL CHARACTERISTICS

MULTIPLE R	.95727	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFIC
R SQUARE	.91637	REGRESSION	1.	2.99736	2.99736	635.54797	0
ADJUSTED R SQUARE	.91493	RESIDUAL	58.	.27354	.00472		
STD DEVIATION	.06867	COEFF OF VARIABILITY	6.0 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
OPCHAR	1.2854872	.50991007E-01	635.54797 / 0	.9572732 / 1.25488
(CONSTANT)	-.29265023	.57835994E-01	25.603619 / .000	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANCE
DERSS	-.22046	.41493	2.9118940 / .093
MISREQ	-.00865	.77513	.42615486 / .948
TIME	.06775	.88286	.26287037 / .610

* *

VARIABLE(S) ENTERED ON STEP NUMBER 2..   DERSS   DESIGN REQMT-SPEC STANDARDS

MULTIPLE R	.95939	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFIC.
R SQUARE	.92044	REGRESSION	2.	3.01065	1.50533	329.70494	0
ADJUSTED R SQUARE	.91764	RESIDUAL	57.	.26024	.00457		
STD DEVIATION	.06757	COEFF OF VARIABILITY	5.9 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
OPCHAR	1.3871483	.77886713E-01	317.18968 / 0	1.0329780 / 1.35413
DERSS	-.37919916E-01	.22221818E-01	2.9118940 / .093	-.0989736 / -.04171
(CONSTANT)	-.35870255	.68822695E-01	27.164742	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANCE
MISREQ	.42075	.16175	12.045947 / .001
TIME	.02533	.84843	.35945902 / .850

FILE WARD (CREATION DATE = 18 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIAB INTERFAC INTERFACE REQMTS

VARIABLE(S) ENTERED ON STEP NUMBER 3.. MISREQ MISSION REQUIREMENTS

MULTIPLE R	.96671	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.93452	REGRESSION	3.	3.05672	1.01891	266.41396	0
ADJUSTED R SQUARE	.93101	RESIDUAL	56.	.21417	.00382		
STD DEVIATION	.06184	COEFF OF VARIABILITY	5.4 PCT				

------------------ VARIABLES IN THE EQUATION ------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
OPCHAR	1.5677667	.88259852E-01	115.52698	1.1674884
			0	1.53044
DERSS	-.17538342	.44523338E-01	15.516786	-.4577628
			.000	-.19292
MISREQ	2.0691951	.59618498	12.045947	.2950948
			.001	1.01569
(CONSTANT)	-2.4722434	.61221183	16.307228	
			.000	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
TIME	.03116	.04839	.53470941
			.018

262

FILE WARD (CREATION DATE = 18 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. INTERFAC INTERFACE REQMTS

VARIABLE(S) ENTERED ON STEP NUMBER 4.. TIME TIME FROM SPEC START

MULTIPLE R	.96674	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.93459	REGRESSION	4.	3.05693	.76423	196.44650	0
ADJUSTED R SQUARE	.92983	RESIDUAL	55.	.21397	.00389		
STD DEVIATION	.06237	COEFF OF VARIABILITY	5.4 PCT				

------------------- VARIABLES IN THE EQUATION ---------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
OPCHAR	1.5613107	.93291088E-01	280.09048	1.1626727
			0	1.52414
DERSS	-.17449250	.45069425E-01	14.989501	-.4554374
			.000	-.19194
MISREQ	2.0701600	.60130286	11.852901	.2952327
			.001	1.01654
TIME	.26396471E-03	.11415290E-02	.53470941E-01	.0086500
			.818	.00302
(CONSTANT)	-2.4705794	.61749338	16.007851	
			.000	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
OPCHAR	1.5613107	.93291088E-01	16.735900	1.3743512 ,	1.7482702
DERSS	-.17449250	.45069425E-01	-3.8716380	-.26481365 ,	-.84171351E-01
MISREQ	2.0701600	.60130286	3.4428043	.86513018 ,	3.2752059
TIME	.26396471E-03	.11415290E-02	.23123785	-.20237105E-02,	.25516400E-02
CONSTANT	-2.4705794	.61749338	-4.0009812	-3.7080638 ,	-1.2330950

FILE WARD (CREATION DATE = 18 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. INTERFAC INTERFACE REQMTS

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

DERSS	.00203			
MISREQ	-.02400	.36157		
OPCHAR	-.00333	.03144	.00070	
TIME	.00000	.00000	-.00003	.00000
	DERSS	MISREQ	OPCHAR	TIME

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL
1.	1.000000	.9864068	.1359318E-01
2.	1.000000	.9864068	.1359318E-01
3.	1.000000	.9864068	.1359318E-01
4.	1.000000	.9864068	.1359318E-01
5.	1.000000	.9864068	.1359318E-01
6.	1.000000	.9864068	.1359318E-01
7.	1.050000	1.053314	-.3313740E-02
8.	1.000000	.9874627	.1253732E-01
9.	1.000000	.9877266	.1227335E-01
10.	1.000000	.9882546	.1174543E-01
11.	1.000000	.9898384	.1016164E-01
12.	1.000000	.9901023	.9897672E-02
13.	1.000000	.9903663	.9633708E-02
14.	1.300000	1.306604	-.6603612E-02
15.	1.030000	1.024096	.5903584E-02
16.	1.000000	.9877266	.1227335E-01
17.	1.000000	.9882546	.1174543E-01
18.	1.000000	.9898384	.1016164E-01
19.	1.000000	.9898384	.1016164E-01
20.	1.000000	.9903663	.9633708E-02
21.	1.310000	1.545560	-.2355595
22.	1.300000	1.307132	-.7131541E-02
23.	1.030000	1.024624	.5375654E-02
24.	1.000000	.9882546	.1174543E-01
25.	1.000000	.9898384	.1016164E-01
26.	1.000000	.9901023	.9897672E-02
27.	1.000000	.9903663	.9633708E-02
28.	1.680000	1.666358	.1364167E-01
29.	1.300000	1.308715	-.8715329E-02
30.	1.030000	1.026208	.3791866E-02
31.	1.000000	.9898384	.1016164E-01
32.	1.000000	.9901023	.9897672E-02
33.	1.000000	.9903663	.9633708E-02
34.	1.420000	1.461757	-.4175722E-01
35.	1.000000	.9901023	.9897672E-02
36.	1.000000	.9903663	.9633708E-02
37.	1.030000	1.026472	.3527981E-02
38.	1.300000	1.308979	-.8979294E-02
39.	1.680000	1.666622	.1337771E-01
40.	1.780000	1.497889	.2821106
41.	1.030000	1.019756	.1024360E-01
42.	1.030000	1.026736	.3263937E-02
43.	1.300000	1.309243	-.9243259E-02
44.	1.000000	.9903663	.9633708E-02
45.	1.050000	1.163937	-.1139369
46.	1.300000	1.309507	-.9507223E-02
47.	1.000000	.9906303	.9369743E-02
48.	1.580000	1.609728	-.2972763E-01
49.	1.050000	1.164201	-.1142009
50.	1.000000	.9908992	.9105778E-02

-2SD 0.0 R R

FILE WARD (CREATION DATE = 18 SEP 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0
53.	1.580000	1.610783	-.3078349E-01		. I
54.	2.070000	1.959314	.1106855		I .
55.	1.270000	1.278394	-.8393527E-02		. I
56.	1.050000	1.165521	-.1155207	.	I
57.	1.260000	1.206950	.5304557E-01		I .
58.	1.270000	1.280241	-.1024120E-01		. I
59.	1.260000	1.207746	.5225360E-01		I .
60.	1.230000	1.230776	-.7758420E-03		.I

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 60.
NUMBER OF 2 S.D. OUTLIERS 2. OR 3.33 PERCENT OF THE TOTAL

VON NEUMANN RATIO 2.00100 DURBIN-WATSON TEST 1.96772

NUMBER OF POSITIVE RESIDUALS 41.
NUMBER OF NEGATIVE RESIDUALS 19.
NUMBER OF RUNS OF SIGNS 26.

EXPECTED NUMBER OF RUNS OF SIGNS 27.
EXPECTED S.D. OF RUN DISTRIBUTION 3.31400
UNIT NORMAL DEVIATE-
Z=(EXPECTED-OBSERVED)/S.D. -.14078
PROBABILITY OF OBTAINING .GE. ABS(Z) .44402

APPENDIX ELEVEN

COMPUTER RUN WITH 60 TRANSFORMED DATA POINTS
AND TWO INDEPENDENT VARIABLES COMBINED

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MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS
                                                                                      31 AUG 78     PAGE    2
FILE    WARD      (CREATION DATE =  31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * *

VARIABLE              MEAN     STANDARD DEV      CASES

MISREQ              1.0075            .0336         60
DERSS               1.2630            .6146         60
OPINT               2.2690            .4065         60
TIME               13.1333           7.7229         60


CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.


DERSS          .06721
OPINT          .46623      .73030
TIME           .01038      .19226      .34808

              MISREQ      DERSS       OPINT
```

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MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS                                  31 AUG 78     PAGE    3

FILE   WARD     (CREATION DATE =  31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..    OPINT

MEAN RESPONSE          2.26900      STD. DEV.        .40648

VARIABLE(S) ENTERED ON STEP NUMBER   1..   TIME        TIME FROM SPEC START

MULTIPLE R              .34808       ANALYSIS OF VARIANCE     DF       SUM OF SQUARES        MEAN SQUARE            F      SIGNIFIC
R SQUARE                .12116       REGRESSION                1.            1.18187            1.18187           7.99601     0
ADJUSTED R SQUARE       .10601       RESIDUAL                 58.            8.56707             .14771
STD DEVIATION           .38433       COEFF OF VARIABILITY     16.9 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------        ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE          B            STD ERROR B          F             BETA          VARIABLE      PARTIAL     TOLERANCE        F
                                               ------------   ----------                                              -----------
                                               SIGNIFICANCE   ELASTICITY                                              SIGNIFICANC

TIME          .18320324E-01   .64788291E-02    7.9960089       .3480798
                                                    .006        .10604
(CONSTANT)    2.0283931       .98498091E-01    424.08000
                                                    0

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE          B           STD ERROR B          T             95.0 PCT CONFIDENCE INTERVAL

TIME         .18320324E-01   .64788291E-02   2.8277215          .53515388E-02,  .31289110E-01
CONSTANT     2.0283931       .98498091E-01   20.593222          1.8312277    ,  2.2255584

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME          .00004

             TIME
```

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE..   MISREQ   MISSION REQUIREMENTS

MEAN RESPONSE   1.00750   STD. DEV.   .03358

VARIABLE(S) ENTERED ON STEP NUMBER 1..   DERSS   DESIGN REQMT*SPEC STANDARDS

MULTIPLE R	.86721	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.75205	REGRESSION	1.	.05003	.05003	175.92126	0
ADJUSTED R SQUARE	.74778	RESIDUAL	58.	.01649	.00028		
STD DEVIATION	.01686	COEFF OF VARIABILITY	1.7 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
DERSS	.47383953E-01	.35724991E-02	175.92126 0	.8672101 .05940
(CONSTANT)	.94765407	.50098488E-02	35780.030 0	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
OPINT	-.49123	.46666	10.129574 .000

* *

VARIABLE(S) ENTERED ON STEP NUMBER 2..   OPINT

MULTIPLE R	.90165	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFIC
R SQUARE	.81189	REGRESSION	2.	.05401	.02701	123.00349	0
ADJUSTED R SQUARE	.80529	RESIDUAL	57.	.01251	.00022		
STD DEVIATION	.01482	COEFF OF VARIABILITY	1.5 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
DERSS	.61672129E-01	.45949486E-02	180.14266 0	1.1287089 .07731
OPINT	-.29580068E-01	.69471271E-02	10.129574 .000	-.3580696 -.06662

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC

MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS 31 AUG 78 PAGE 6

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. MISREQ MISSION REQUIREMENTS

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
DERSS	.61672129E-01	.45949486E-02	13.421723	.52470903E-01, .70873355E-01
OPINT	-.29580060E-01	.69471271E-02	-4.2578838	-.43491442E-01, -.15668678E-01
CONSTANT	.99672526	.12336804E-01	80.792825	.97202123 , 1.0214293

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

OPINT	.00005	
DERSS	-.00002	.00002
	OPINT	DERSS

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0	
1.	1.000000	.9992373	.7627340E-03			
2.	1.000000	.9992373	.7627340E-03			
3.	1.000000	.9992373	.7627340E-03			
4.	1.000000	.9992373	.7627340E-03			
5.	1.000000	.9992373	.7627340E-03			
6.	1.000000	.9992373	.7627340E-03			
7.	1.000000	1.000596	-.5963091E-03			
8.	1.000000	.9992373	.7627340E-03			
9.	1.000000	.9992373	.7627340E-03			
10.	1.000000	.9992373	.7627340E-03			
11.	1.000000	.9992373	.7627340E-03			
12.	1.000000	.9992373	.7627340E-03			
13.	1.000000	.9992373	.7627340E-03			
14.	1.000000	1.002999	-.2999115E-02			
15.	1.000000	1.001163	-.1162790E-02			
16.	1.000000	.9992373	.7627340E-03			
17.	1.000000	.9992373	.7627340E-03			
18.	1.000000	.9992373	.7627340E-03			
19.	1.000000	.9992373	.7627340E-03			
20.	1.000000	.9992373	.7627340E-03			
21.	1.000000	1.054218	-.5421774E-01	R		
22.	1.000000	1.002999	-.2999115E-02			
23.	1.000000	1.001163	-.1162790E-02			
24.	1.000000	.9992373	.7627340E-03			
25.	1.000000	.9992373	.7627340E-03			
26.	1.000000	.9992373	.7627340E-03			
27.	1.000000	.9992373	.7627340E-03			
28.	1.176000	1.168080	.7920110E-02			
29.	1.000000	1.002999	-.2999115E-02			
30.	1.000000	1.001163	-.1162790E-02			
31.	1.000000	.9992373	.7627340E-03			
32.	1.000000	.9992373	.7627340E-03			
33.	1.000000	.9992373	.7627340E-03			
34.	1.110000	1.020714	.8928617E-01			R
35.	1.000000	.9992373	.7627340E-03			
36.	1.000000	.9992373	.7627340E-03			
37.	1.000000	1.001163	-.1162790E-02			
38.	1.000000	1.002999	-.2999115E-02			
39.	1.170000	1.162080	.7920110E-02			
40.	1.000000	1.010908	-.1090781E-01			
41.	1.000000	1.003630	-.3629675E-02			
42.	1.000000	1.001163	-.1162790E-02			
43.	1.000000	1.002999	-.2999115E-02			
44.	1.000000	.9992373	.7627340E-03			
45.	1.000000	1.004397	-.4397117E-02			
46.	1.000000	1.002999	-.2999115E-02			
47.	1.000000	.9992373	.7627340E-03			
48.	1.000000	.9983724	.1627573E-02			
49.	1.000000	1.004397	-.4397117E-02			
50.	1.000000	.9992373	.7627340E-03			
51.	1.000000	.9893308	.1066923E-01			
52.	1.000000	1.004397	-.4397117E-02			

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MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS                                   31 AUG 78    PAGE   9

FILE   WARD     (CREATION DATE =  31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * *

OBSERVATION     Y VALUE        Y ESTIMATE          RESIDUAL        -2SD                             0.0

   53.         1.000000        .9983724         .1627573E-02                                        I .
   54.         1.000000        1.001794        -.1793876E-02                                      . I
   55.         1.000000        .9893308         .1066923E-01                                        I       .
   56.         1.000000        1.004397        -.4397117E-02                                   .    I
   57.         1.000000        1.015529        -.1552886E-01                         .              I
   58.         1.000000        .9893308         .1066923E-01                                        I       .
   59.         1.000000        1.015529        -.1552886E-01                         .              I
   60.         1.000000        1.018908        -.1898827E-01                     .                  I

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
       R INDICATES POINT OUT OF RANGE OF PLOT


NUMBER OF CASES PLOTTED         60.
NUMBER OF 2 S.D. OUTLIERS        2. OR    3.33 PERCENT OF THE TOTAL

VON NEUMANN RATIO     1.98735           DURBIN-WATSON TEST     1.95423

NUMBER OF POSITIVE RESIDUALS      37.
NUMBER OF NEGATIVE RESIDUALS      23.
NUMBER OF RUNS OF SIGNS           24.

EXPECTED NUMBER OF RUNS OF SIGNS            29.
EXPECTED S.D. OF RUN DISTRIBUTION       3.62735
UNIT NORMAL DEVIATE-
  Z=(EXPECTED-OBSERVED)/S.D.           -1.39166
PROBABILITY OF OBTAINING .GE. ABS(Z)     .08985
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FILE    WARD      (CREATION DATE =  31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * *  M U L T I P L E   R E G R E S S I O N  * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..     UPINT

MEAN RESPONSE          2.26900      STD. DEV.         .40640

VARIABLE(S) ENTERED ON STEP NUMBER   1..   DERSS      DESIGN REQMT*SPEC STANDARDS

MULTIPLE R             .73030         ANALYSIS OF VARIANCE    DF       SUM OF SQUARES        MEAN SQUARE           F      SIGNIFI
R SQUARE               .53334         REGRESSION              1.             5.19900           5.19900        66.28765     0
ADJUSTED R SQUARE      .52529         RESIDUAL               58.             4.54906            .07843
STD DEVIATION          .28006         COEFF OF VARIABILITY   12.3 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE          B           STD ERROR B        F             BETA             VARIABLE      PARTIAL    TOLERANCE       F
                                            ------------   ----------                                                 ----------
                                            SIGNIFICANCE   ELASTICITY                                                 SIGNIFICANC

DERSS        .48303405     .59328234E-01     66.287654      .7303017          MISREQ        -.49123     .24795      18.129574
                                                  .000      .26887                                                     .000
(CONSTANT)   1.6589280     .83198197E-01     397.58249
                                                  .000

* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

VARIABLE(S) ENTERED ON STEP NUMBER   2..   MISREQ     MISSION REQUIREMENTS

MULTIPLE R             .80371         ANALYSIS OF VARIANCE    DF       SUM OF SQUARES        MEAN SQUARE           F      SIGNIFIC
R SQUARE               .64595         REGRESSION              2.             6.29682           3.14841        51.99723     0
ADJUSTED R SQUARE      .63353         RESIDUAL               57.             3.45132            .06055
STD DEVIATION          .24607         COEFF OF VARIABILITY   10.8 PCT

-------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE          B           STD ERROR B        F             BETA             VARIABLE      PARTIAL    TOLERANCE       F
                                            ------------   ----------                                                 ----------
                                            SIGNIFICANCE   ELASTICITY                                                 SIGNIFICANC

DERSS        .86958693     .10468653         68.999255      1.3147331
                                                  0         .48400
MISREQ       -8.1578860    1.9159485         18.129574     -.6739213
                                                  .000     -3.62233
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FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. OPINT

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
DERSS	.86958693	.10468653	8.3065790	.65995577	, 1.0792181
MISREQ	-8.1578860	1.9159485	-4.2578838	-11.994507	, -4.3212653
CONSTANT	9.3897818	1.8171274	5.1673768	5.7510470	, 13.028517

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

MISREQ	3.67086	
DERSS	-.17394	.01096
	MISREQ	DERSS

AD-A107 875 AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH F/G 5/1
A STUDY OF RESEARCH AND DEVELOPMENT CONTRACT REQUIREMENTS AND T--ETC(U)
MAY 79 R G BLACKLEDGE
UNCLASSIFIED AFIT-CI-79-214D NL

4 OF 4
AD A
107875

END
DATE
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11-82
DTIC

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD		0.0	
1.	2.000000	2.101483	-.1014828		.	I	
2.	2.000000	2.101483	-.1014828		.	I	
3.	2.000000	2.101483	-.1014828		.	I	
4.	2.000000	2.101483	-.1014828		.	I	
5.	2.000000	2.101483	-.1014828		.	I	
6.	2.000000	2.101483	-.1014828		.	I	
7.	2.100000	2.162354	-.6235387E-01		.	I	
8.	2.000000	2.101483	-.1014828		.	I	
9.	2.000000	2.101483	-.1014828		.	I	
10.	2.000000	2.101483	-.1014828		.	I	
11.	2.000000	2.101483	-.1014828		.	I	
12.	2.000000	2.101483	-.1014828		.	I	
13.	2.000000	2.101483	-.1014828		.	I	
14.	2.540000	2.379751	.1602494			I	.
15.	2.060000	2.153658	-.9365800E-01		.	I	
16.	2.000000	2.101483	-.1014828		.	I	
17.	2.000000	2.101483	-.1014828		.	I	
18.	2.000000	2.101483	-.1014828		.	I	
19.	2.000000	2.101483	-.1014828		.	I	
20.	2.000000	2.101483	-.1014828		.	I	
21.	2.810000	3.214554	-.4045541	.		I	
22.	2.540000	2.379751	.1602494			I	.
23.	2.060000	2.153658	-.9365800E-01		.	I	
24.	2.000000	2.101483	-.1014828		.	I	
25.	2.000000	2.101483	-.1014828		.	I	
26.	2.000000	2.101483	-.1014828		.	I	
27.	2.000000	2.101483	-.1014828		.	I	
28.	3.250000	3.532104	-.2821038	.		I	
29.	2.540000	2.379751	.1602494			I	.
30.	2.060000	2.153658	-.9365800E-01		.	I	
31.	2.000000	2.101483	-.1014828		.	I	
32.	2.000000	2.101483	-.1014828		.	I	
33.	2.000000	2.101483	-.1014828		.	I	
34.	2.650000	1.778043	.8719573			I	R
35.	2.000000	2.101483	-.1014828		.	I	
36.	2.000000	2.101483	-.1014828		.	I	
37.	2.060000	2.153658	-.9365800E-01		.	I	
38.	2.540000	2.379751	.1602494			I	.
39.	3.250000	3.532104	-.2821038	.		I	
40.	3.190000	2.762369	.4276311			I	.
41.	2.060000	2.188441	-.1284415		.	I	
42.	2.060000	2.153658	-.9365800E-01		.	I	
43.	2.540000	2.379751	.1602494			I	.
44.	2.000000	2.101483	-.1014828		.	I	
45.	2.180000	2.249313	-.6931256E-01		.	I	
46.	2.540000	2.379751	.1602494			I	.
47.	2.000000	2.101483	-.1014828		.	I	
48.	3.030000	2.510885	.5191155			I	R
49.	2.180000	2.249313	-.6931256E-01		.	I	
50.	2.000000	2.101483	-.1014828		.	I	

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MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS                                      31 AUG 78 , PAGE 14

FILE   WAPD    (CREATION DATE =  31 AUG 78)   WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * * * * * M U L T I P L E   R E G R E S S I O N * * * * * * * * * * * * * * * * * * * * * * *

OBSERVATION     Y VALUE       Y ESTIMATE       RESIDUAL        -250                        0.0

   53.         3.030000       2.518885        .5111155                                      I                  R
   54.         3.790000       2.884111        .9058890                                      I                  R
   55.         2.460000       2.153658        .3063420                                      I         .
   56.         2.180000       2.249313       -.6931256E-01                               .  I
   57.         2.450000       2.518885       -.6888451E-01                               .  I
   58.         2.460000       2.153658        .3063420                                      I         .
   59.         2.450000       2.518885       -.6888451E-01                               .  I
   60.         2.440000       2.562364       -.1223639                                 .     I

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
       R INDICATES POINT OUT OF RANGE OF PLOT


NUMBER OF CASES PLOTTED        60.
NUMBER OF 2 S.D. OUTLIERS       4, OR    6.67 PERCENT OF THE TOTAL

VON NEUMANN RATIO    1.89388          DURBIN-WATSON TEST     1.86232

NUMBER OF POSITIVE RESIDUALS     14.
NUMBER OF NEGATIVE RESIDUALS     46.
NUMBER OF RUNS OF SIGNS          25.

EXPECTED NUMBER OF RUNS OF SIGNS          22.
EXPECTED S.D. OF RUN DISTRIBUTION       2.72885
UNIT NORMAL DEVIATE-
  Z=(EXPECTED-OBSERVED)/S.D.            1.11158
PROBABILITY OF OBTAINING .GE. ABS(Z)     .13316
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* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE..   DERSS   DESIGN REQMT&SPEC STANDARDS

MEAN RESPONSE   1.26308   STD. DEV.   .61455

VARIABLE(S) ENTERED ON STEP NUMBER 1.. MISREQ   MISSION REQUIREMENTS

MULTIPLE R	.86721	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFICANCE
R SQUARE	.75205	REGRESSION	1.	16.75790	16.75790	175.92126	0
ADJUSTED R SQUARE	.74778	RESIDUAL	58.	5.52496	.09526		
STD DEVIATION	.30864	COEFF OF VARIABILITY	24.4 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
MISREQ	15.871477	1.1966253	175.92126 / 0	.8672101 / 12.66874
(CONSTANT)	-14.727513	1.2662582	149.86588 / 0	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANCE
OPINT	.74081	.78263	68.999255 / 0

* *

VARIABLE(S) ENTERED ON STEP NUMBER 2.. OPINT

MULTIPLE R	.94225	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFICANCE
R SQUARE	.88783	REGRESSION	2.	19.78346	9.89173	225.58539	0
ADJUSTED R SQUARE	.88390	RESIDUAL	57.	2.49948	.04385		
STD DEVIATION	.20940	COEFF OF VARIABILITY	16.6 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
MISREQ	12.317369	.91771886	180.14266 / 0	.6738153 / 9.82561
OPINT	.62974310	.75812570E-01	68.999255 / 0	.4165229 / 1.13134
(CONSTANT)	-12.575636	.85843083	214.60968	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANCE

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. DLRSS DESIGN REQMT&SPEC STANDARDS

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
MISREQ	12.317369	.91771886	13.421723	10.479668	, 14.155069
OPINT	.62974310	.75612570E-01	8.3865790	.47793105	, .78155516
CONSTANT	-12.575636	.85843083	-14.649562	-14.294614	, -10.856658

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

MISREQ	.84221	
OPINT	-.03244	.00575
	MISREQ	OPINT

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0
1.	1.000000	1.001219	-.1218840E-02		
2.	1.000000	1.001219	-.1218840E-02		
3.	1.000000	1.001219	-.1218840E-02		
4.	1.000000	1.001219	-.1218840E-02		
5.	1.000000	1.001219	-.1218840E-02		
6.	1.000000	1.001219	-.1218840E-02		
7.	1.070000	1.064193	.5806849E-02		
8.	1.000000	1.001219	-.1218840E-02		
9.	1.000000	1.001219	-.1218840E-02		
10.	1.000000	1.001219	-.1218840E-02		
11.	1.000000	1.001219	-.1218840E-02		
12.	1.000000	1.001219	-.1218840E-02		
13.	1.000000	1.001219	-.1218840E-02		
14.	1.320000	1.341280	-.2128012E-01		
15.	1.060000	1.039003	.2099657E-01		
16.	1.000000	1.001219	-.1218840E-02		
17.	1.000000	1.001219	-.1218840E-02		
18.	1.000000	1.001219	-.1218840E-02		
19.	1.000000	1.001219	-.1218840E-02		
20.	1.000000	1.001219	-.1218840E-02		
21.	2.280000	1.511311	.7686892		R
22.	1.320000	1.341280	-.2128012E-01		
23.	1.060000	1.039003	.2099657E-01		
24.	1.000000	1.001219	-.1218840E-02		
25.	1.000000	1.001219	-.1218840E-02		
26.	1.000000	1.001219	-.1218840E-02		
27.	1.000000	1.001219	-.1218840E-02		
28.	4.240000	3.882350	.3576496		
29.	1.320000	1.341280	-.2128012E-01		
30.	1.060000	1.039003	.2099657E-01		
31.	1.000000	1.001219	-.1218840E-02		
32.	1.000000	1.001219	-.1218840E-02		
33.	1.000000	1.001219	-.1218840E-02		
34.	1.660000	2.765462	-1.105462	R	
35.	1.000000	1.001219	-.1218840E-02		
36.	1.000000	1.001219	-.1218840E-02		
37.	1.060000	1.039003	.2099657E-01		
38.	1.320000	1.341280	-.2128012E-01		
39.	4.240000	3.882350	.3576496		
40.	1.760000	1.750613	.9386860E-02		
41.	1.100000	1.039003	.6099657E-01		
42.	1.060000	1.039003	.2099657E-01		
43.	1.320000	1.341280	-.2128012E-01		
44.	1.000000	1.001219	-.1218840E-02		
45.	1.170000	1.114573	.5542740E-01		
46.	1.320000	1.341280	-.2128012E-01		
47.	1.000000	1.001219	-.1218840E-02		
48.	1.480000	1.649854	-.1698542		
49.	1.170000	1.114573	.5542740E-01		
50.	1.000000	1.001219	-.1218840E-02		
51.	1.060000	1.290901	-.2309007		
52.	1.170000	1.114573	.5542740E-01		

FILE WARD (CREATION DATE = 31 AUG 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0
53.	1.480000	1.649854	-.1698542		I
54.	1.900000	2.128459	-.2284590		I
55.	1.060000	1.290901	-.2309007		I
56.	1.170000	1.114573	.5542748E-01		I
57.	1.480000	1.284603	.1953968		I
58.	1.060000	1.290901	-.2309007		I
59.	1.480000	1.284603	.1953968		I
60.	1.530000	1.278306	.2516942		I

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 60.
NUMBER OF 2 S.D. OUTLIERS 2. OR 3.33 PERCENT OF THE TOTAL

VON NEUMANN RATIO 2.01724 DURBIN-WATSON TEST 1.98362

NUMBER OF POSITIVE RESIDUALS 18.
NUMBER OF NEGATIVE RESIDUALS 42.
NUMBER OF RUNS OF SIGNS 26.

EXPECTED NUMBER OF RUNS OF SIGNS 26.
EXPECTED S.D. OF RUN DISTRIBUTION 3.21581
UNIT NORMAL DEVIATE-
Z=(EXPECTED-OBSERVED)/S.D. .09331
PROBABILITY OF OBTAINING .GE. ABS(Z) .46283

APPENDIX TWELVE

COMPUTER RUN WITH 60 TRANSFORMED DATA POINTS AND MISSION REQUIREMENTS TREATED AS TIME DEPENDENT

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FILE WARD (CREATION DATE = 04 OCT 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

VARIABLE	MEAN	STANDARD DEV	CASES
MISRED	1.0005	.0022	60
OPCHAR	1.1208	.1751	60
DERSS	1.2630	.6196	60
INTERFAC	1.1482	.2355	60
TIME	13.1333	1.7229	60

CORRELATION COEFFICIENTS.

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

	MISRED	OPCHAR	DERSS	INTERFAC
OPCHAR	.56312			
DERSS	.[illegible]690	.70470		
INTERFAC	.[illegible]3741	.25727	.69111	
TIME	.11598	.34225	.14726	.34606

MULTIPLE REGRESSION OF WEAPON ACQUISITION [illegible]

FILE WARD (CREATION DATE = 04 OCT 78) WEAPON ACQUISITION REQUIREMENTS DATA

* MULTIPLE REGRESSION *

DEPENDENT VARIABLE.. MISREQ MISSION REQUIREMENTS

MEAN RESPONSE 1.00050 STD. DEV. .00220

VARIABLE(S) ENTERED ON STEP NUMBER 1.. TIME TIME FROM SHIP START

MULTIPLE R	.01590	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIF	
R SQUARE	.00026	REGRESSION	1.	.00000	.00000	.01481	.90	
ADJUSTED R SQUARE	-.01690	RESIDUAL	58.	.00028	.00000			
STD DEVIATION	.00222	COEFF OF VARIABILITY	.2 PCT					

------------------ VARIABLES IN THE EQUATION ------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
TIME	.8546P324E-05	.37363494E-06	.14800 / 29035E-01 .704	.0159764 / .00006
(CONSTANT)	1.0004403	.56803900E-03	3101878.7 / .000	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANCE

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
TIME	.8546P324E-05	.37363490E-06	.12167184	-.73764327E-05, .79333793E-04
CONSTANT	1.0004403	.56803900E-03	1761.2151	.99930123 , 1.0015773

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME	.00000
	TIME

MULTIPLE REGRESSION

DEPENDENT VARIABLE.. OPCHAR OPERATIONAL CHARACTERISTICS

MEAN RESPONSE 1.12061 STD. DEV. .17536

VARIABLE(S) ENTERED ON STEP NUMBER 1.. TIME TIME FROM SEC START

MULTIPLE R	.34225	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFICANCE
R SQUARE	.11714	REGRESSION	1.	.21247	.21247	7.69524	0
ADJUSTED R SQUARE	.10191	RESIDUAL	58.	1.60139	.02761		
STD DEVIATION	.16616	COEFF OF VARIABILITY	14.8 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
TIME	.77763471E-02	.28011037E-02	7.6952447 / .007	.3422506 / .09105
(CONSTANT)	1.0167628	.42585377E-01	572.12436 / 0	

---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANCE

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
TIME	.77763471E-02	.28011037E-02	2.7740304	.21733267E-02, .13377365E-01
CONSTANT	1.0167628	.42585377E-01	23.923101	[illegible] , 1.1040267

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME .00001

TIME

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[illegible] ACQUISITION [illegible] REQUIREMENTS [illegible] PAGE 5

[illegible]

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MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS                    04 OCT 78      PAGE   7

FILE    WARD      (CREATION DATE =  04 OCT 78)    WEAPON ACQUISITION REQUIREMENTS DATA

* * * * * * * * * * * * * * * * * * * * M U L T I P L E     R E G R E S S I O N * * * * * * * * * * * * * * * * * * * * *

DEPENDENT VARIABLE..     DEMSS       DESIGN REQMT-SPEC STANDARDS

MEAN RESPONSE         1.26300       STD. DEV.        .61955

VARIABLE(S) ENTERED ON STEP NUMBER   1..    TIME        TIME FROM SPEC START

MULTIPLE R              .14226          ANALYSIS OF VARIANCE      DF       SUM OF SQUARES        MEAN SQUARE            F      SIGNIFI
R SQUARE                .02024          REGRESSION                 1.              .45076             .45096         1.19806    .28
ADJUSTED R SQUARE       .00335          RESIDUAL                  58.            21.93190             .37641
STD DEVIATION           .61352          COEFF OF VARIABILITY      48.6 PCT

------------------- VARIABLES IN THE EQUATION ---------------------          ---------- VARIABLES NOT IN THE EQUATION -------

VARIABLE          B             STD ERROR B          F            BETA          VARIABLE      PARTIAL     TOLERANCE         F
                                                ------------   ----------                                                ----------
                                                SIGNIFICANCE   ELASTICITY                                                SIGNIFICANC

TIME        .11320476E-01    .10342517E-01     1.1980554        .1422605
                                                    .278          .11772
(CONSTANT)  1.1143244         .15723800        50.2231647
                                                    .000

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE          B             STD ERROR B          T             95.0 PCT CONFIDENCE INTERVAL

TIME        .11320476E-01    .10342517E-01     1.0945572       -.9381326E-02,   .32021272E-01
CONSTANT    1.1143244         .15723800        7.0868445        .7996436    ,   1.4290705

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME          .00011

            TIM
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FILE WARD (CREATION DATE = 04 OCT 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. INTERFAC INTERFACE REPORTS

MEAN RESPONSE 1.14017 STD. DEV. .23545

VARIABLE(S) ENTERED ON STEP NUMBER 1.. TIME TIME FROM SPEC START

		ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
MULTIPLE R	.34604						
R SQUARE	.11974	REGRESSION	1.	.39166	.39166	7.88970	0
ADJUSTED R SQUARE	.10457	RESIDUAL	58.	2.87923	.04964		
STD DEVIATION	.22280	COEFF OF VARIABILITY	19.4 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
TIME	.10569377E-01	.37559427E-02	7.8849842 / .007	.3460378 / .12951
(CONSTANT)	1.0096103	.57101860E-01	312.61300 / 0	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANCE

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
TIME	.10569377E-01	.37559427E-02	2.8080760	.30316410E-02, .18066314E-01
CONSTANT	1.0096103	.57101860E-01	17.680665	.8953085, 1.1239121

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

TIME	.00001
	TIME

FILE WARD (CREATION DATE = 04 OCT 79) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. MISREQ MISSION REQUIREMENTS

MEAN RESPONSE 1.00000 STD. DEV. .00220

VARIABLE(S) ENTERED ON STEP NUMBER 1.. DERSS DESIGN REQMTS/SPEC STANDARDS

MULTIPLE R	.79696	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.63514	REGRESSION	1.	.00018	.00018	100.96441	0
ADJUSTED R SQUARE	.62895	RESIDUAL	58.	.00010	.00000		
STD DEVIATION	.00134	COEFF OF VARIABILITY	.1 PCT				

------------------ VARIABLES IN THE EQUATION ------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
DERSS	.23601727E-02	.28365215E-03	100.96441 / .000	.7969558 / .00360
(CONSTANT)	.99769023	.39777684E-03	6290936.7 / 0	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
OPCHAR	-.42784	.41491	12.771776 / .001
INTERFAC	-.25976	.62211	4.1251196 / .047

* *

VARIABLE(S) ENTERED ON STEP NUMBER 2.. OPCHAR OPERATIONAL CHARACTERISTICS

MULTIPLE R	.83781	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFIC
R SQUARE	.70193	REGRESSION	2.	.00020	.00010	67.11905	0
ADJUSTED R SQUARE	.69147	RESIDUAL	57.	.00008	.00000		
STD DEVIATION	.00122	COEFF OF VARIABILITY	.1 PCT				

------------------ VARIABLES IN THE EQUATION ------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
DERSS	.3476003E-02	.41400721E-03	70.67520 / 0	1.1[illegible] / .00[illegible]
OPCHAR	-.52290140E-02	.14672044E-02	12.771776 / .001	-.4412011 / -.00[illegible]
(CONSTANT)	1.0011508	.12934413E-02	599025.16 / 0	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
INTERFAC	.38026	.07956	9.4641276 / .003

FILE WARD (CREATION DATE = 06 OCT 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. MISREQ MISSION REQUIREMENTS

VARIABLE(S) ENTERED ON STEP NUMBER 1.. INTERFAC INTERFACE NEEDS

MULTIPLE R	.86119	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFICANCE
R SQUARE	.74502	REGRESSION	3.	.00021	.00007	54.54191	0
ADJUSTED R SQUARE	.73136	RESIDUAL	56.	.00007	.00000		
STD DEVIATION	.00114	COEFF OF VARIABILITY	.1 PCT				

------------------ VARIABLES IN THE EQUATION ------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
DERSS	.42601036E-02	.3940658[illegible]E-03	120.0[illegible] / 0	1.17[illegible] / .00531
OPCHAD	-.14558109E-01	.3104[illegible]E-02	18.72[illegible] / .000	-1.191412[illegible] / -.01611
INTERFAC	.70696154E-02	.22330175E-02	9.4661270 / .003	.7[illegible] / .00709
(CONSTANT)	1.0036149	.14099019E-02	50670[illegible] / .000	

------------------ VARIABLES NOT IN THE EQUATION ------------------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANCE

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
DERSS	.42601036E-02	.38400580E-03	10.956311	.34[illegible]E-02,	.49775799E-02
OPCHAD	-.14558109E-01	.3364351[illegible]E-02	-4.3271199	-.212[illegible]E-01,	-.781[illegible]E-02
INTERFAC	.70696154E-02	.22330175E-02	3.0761122	.239561437E-02,	.11342087E-01
CONSTANT	1.0036149	.14099019E-02	711.83315	1.0007906	1.006[illegible]

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

OPCHAD	.00001		
DERSS	-.00000	.00000	
INTERFAC	-.00001	.00000	.00000
	OPCHAD	DERSS	INTERFAC

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL
1.	1.000000	1.000135	-.1345196E-03
2.	1.000000	1.000135	-.1345196E-03
3.	1.000000	1.000135	-.1345196E-03
4.	1.000000	1.000135	-.1345196E-03
5.	1.000000	1.000135	-.1345196E-03
6.	1.000000	1.000135	-.1345196E-03
7.	1.000000	1.000045	-.4500227E-04
8.	1.000000	1.000135	-.1345196E-03
9.	1.000000	1.000135	-.1345196E-03
10.	1.000000	1.000135	-.1345196E-03
11.	1.000000	1.000135	-.1345196E-03
12.	1.000000	1.000135	-.1345196E-03
13.	1.000000	1.000135	-.1345196E-03
14.	1.000000	1.000048	-.4805102E-04
15.	1.000000	1.000156	-.1563521E-03
16.	1.000000	1.000135	-.1345196E-03
17.	1.000000	1.000135	-.1345196E-03
18.	1.000000	1.000135	-.1345196E-03
19.	1.000000	1.000135	-.1345196E-03
20.	1.000000	1.000135	-.1345196E-03
21.	1.000000	1.000371	-.3714556E-03
22.	1.000000	1.000048	-.4805102E-04
23.	1.000000	1.000156	-.1563521E-03
24.	1.000000	1.000135	-.1345196E-03
25.	1.000000	1.000135	-.1345196E-03
26.	1.000000	1.000135	-.1345196E-03
27.	1.000000	1.000135	-.1345196E-03
28.	1.010000	1.010142	-.1421400E-03
29.	1.000000	1.000048	-.4805102E-04
30.	1.000000	1.000156	-.1563521E-03
31.	1.000000	1.000135	-.1345196E-03
32.	1.000000	1.000135	-.1345196E-03
33.	1.000000	1.000135	-.1345196E-03
34.	1.010000	1.002449	.7551238E-02
35.	1.000000	1.000135	-.1345196E-03
36.	1.000000	1.000135	-.1345196E-03
37.	1.000000	1.000156	-.1563521E-03
38.	1.000000	1.000048	-.4805102E-04
39.	1.010000	1.010142	-.1421400E-03
40.	1.000000	1.002722	-.2722166E-02
41.	1.000000	1.000325	-.3246787E-03
42.	1.000000	1.000156	-.1563521E-03
43.	1.000000	1.000048	-.4805102E-04
44.	1.000000	1.000135	-.1345196E-03
45.	1.000000	.9993008	.6991766E-03
46.	1.000000	1.000048	-.4805102E-04
47.	1.000000	1.000135	-.1345196E-03
48.	1.000000	.9995876	.4123704E-03
49.	1.000000	.9993008	.6991766E-03
50.	1.000000	1.000135	-.1345196E-03
51.	1.000000	.9994757	.5243054E-03
52.	1.000000	.9993008	.6991766E-03

-2.50 0.0

R

MULTIPLE REGRESSION OF WEAPON ACQUISITION REQUIREMENTS   04 OCT 78   PAGE 15

FILE WARD (CREATION DATE = 04 OCT 78) WEAPON ACQUISITION REQUIREMENT, DATA

* M U L T I P L E   R E G R E S S I O N *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-.250	0.0
53.	1.000000	.999876	.1247708E-03		I
54.	1.000000	1.001720	-.1720000E-03		I
55.	1.000000	.999757	.2425000E-03		I
56.	1.000000	.9993008	.6991765E-03		I
57.	1.000000	1.001174	-.1174482E-02		I
58.	1.000000	.999475	.5242500E-03		I
59.	1.000001	1.001174	-.1174482E-02		I
60.	1.000000	1.000808	-.8076180E-03		I

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 60.
NUMBER OF 2 S.D. OUTLIERS 2. OR 3.33 PERCENT OF THE TOTAL

VON NEUMANN RATIO 2.04733   DURBIN-WATSON TEST 2.01321

NUMBER OF POSITIVE RESIDUALS 10.
NUMBER OF NEGATIVE RESIDUALS 50.
NUMBER OF RUNS OF SIGNS 13.

NORMAL APPROXIMATION TO SIGN DISTRIBUTION IMPOSSIBLE.
USE A TABLE FOR EXPECTED VALUES.

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. OPCHAR OPERATIONAL CHARACTERISTICS

MEAN RESPONSE 1.12003 STD. DEV. .17514

VARIABLE(S) ENTERED ON STEP NUMBER 1.. INTERFAC INTERFACE REQMTS

MULTIPLE R	.95727	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.91637	REGRESSION	1.	1.66217	1.66217	635.56797	0
ADJUSTED R SQUARE	.91473	RESIDUAL	58.	.15169	.00262		
STD DEVIATION	.05114	COEFF OF VARIABILITY	4.6 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
INTERFAC	.71285972	.28276777E-01	635.56797	.95727732
			0	.73024
(CONSTANT)	.31535157	.34130946E-01	83.284091	
			.000	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
MISREQ	.09382	.80867	.50623250
			.480
DERSS	.49417	.52231	18.416769
			.000

* *

VARIABLE(S) ENTERED ON STEP NUMBER 2.. DERSS DESIGN REQMTS/SPEC STANDARDS

MULTIPLE R	.96780	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFIC
R SQUARE	.93677	REGRESSION	2.	1.69921	.84961	422.40694	0
ADJUSTED R SQUARE	.93456	RESIDUAL	57.	.11465	.00201		
STD DEVIATION	.04485	COEFF OF VARIABILITY	4.0 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
INTERFAC	.61108081	.34311946E-01	317.17768	[illegible]
			0	[illegible]
DERSS	.27415050E-01	.13145977E-01	18.416769	[illegible]
			.000	[illegible]

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
MISREQ	-.50056	.34026	18.724573
			.000

FILE WARD (CREATION DATE = 06 OCT 70) WEAPON ACQUISITION REQUIREMENTS DATA

* MULTIPLE REGRESSION *

DEPENDENT VARIABLE.. OPCHAR OPERATIONAL CHARACTERISTICS

VARIABLE(S) ENTERED ON STEP NUMBER 1.. MISREQ MISSION REQUIREMENTS

MULTIPLE R	.97603	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.95263	REGRESSION	3.	1.72796	.57598	375.41276	0
ADJUSTED R SQUARE	.95007	RESIDUAL	56.	.08592	.00153		
STD DEVIATION	.03917	COEFF OF VARIABILITY	[illegible] PCT				

---------------------- VARIABLES IN THE EQUATION ---------------------- ------------ VARIABLES NOT IN THE EQUATION -------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY	VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
INTERFAC	.57620394	.31032943E-01	394.75179	.7737632				
			0	.59026				
DERSS	.11471149	.17700825E-01	41.997827	.4020534				
			.000	.12966				
MISREQ	-17.515387	3.9777287	18.724573	-.2157555				
			.000	-15.[illegible]				
(CONSTANT)	17.545368	3.9720506	19.489479					
			.000					

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
INTERFAC	.57620394	.31032943E-01	18.567693	.51413749 ,	.63837090
DERSS	.11471149	.17700825E-01	6.4805731	.79[illegible]76E-01 ,	.15017050
MISREQ	-17.515387	3.9777288	-4.3271130	-25.180735 ,	-9.2440392
CONSTANT	17.545368	3.9720506	4.4146[illegible]	9.579[illegible]46 ,	25.492[illegible]

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

MISREQ	15.[illegible]		
DERSS	-.[illegible]54	.00031	
INTERFAC	.[illegible]07	-.00035	.00[illegible]

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL
1.	1.000000	1.013096	-.1309619E-01
2.	1.000000	1.013096	-.1309619E-01
3.	1.000000	1.013096	-.1309619E-01
4.	1.000000	1.013096	-.1309619E-01
5.	1.000000	1.013096	-.1309619E-01
6.	1.000000	1.013096	-.1309619E-01
7.	1.050000	1.050736	-.7361492E-03
8.	1.000000	1.013096	-.1309619E-01
9.	1.000000	1.013096	-.1309619E-01
10.	1.000000	1.013096	-.1309619E-01
11.	1.000000	1.013096	-.1309619E-01
12.	1.000000	1.013096	-.1309619E-01
13.	1.000000	1.013096	-.1309619E-01
14.	1.240000	1.223465	.1653495E-01
15.	1.030000	1.038065	-.8064995E-02
16.	1.000000	1.013096	-.1309619E-01
17.	1.000000	1.013096	-.1309619E-01
18.	1.000000	1.013096	-.1309619E-01
19.	1.000000	1.013096	-.1309619E-01
20.	1.000000	1.013096	-.1309619E-01
21.	1.500000	1.339950	.1600499
22.	1.240000	1.223465	.1653495E-01
23.	1.030000	1.038065	-.8064995E-02
24.	1.000000	1.013096	-.1309619E-01
25.	1.000000	1.013096	-.1309619E-01
26.	1.000000	1.013096	-.1309619E-01
27.	1.000000	1.013096	-.1309619E-01
28.	1.570000	1.605256	-.3525622E-01
29.	1.240000	1.223465	.1653495E-01
30.	1.030000	1.038065	-.8064995E-02
31.	1.000000	1.013096	-.1309619E-01
32.	1.000000	1.013096	-.1309619E-01
33.	1.000000	1.013096	-.1309619E-01
34.	1.230000	1.159488	.7051245E-01
35.	1.000000	1.013096	-.1309619E-01
36.	1.000000	1.013096	-.1309619E-01
37.	1.030000	1.038065	-.8064995E-02
38.	1.240000	1.223465	.1653495E-01
39.	1.570000	1.605256	-.3525622E-01
40.	1.410000	1.556516	-.1465160
41.	1.030000	1.042051	-.1205106E-01
42.	1.030000	1.038065	-.8064995E-02
43.	1.240000	1.223465	.1653495E-01
44.	1.000000	1.013096	-.1309619E-01
45.	1.140000	1.062267	.7773266E-01
46.	1.240000	1.223465	.1653495E-01
47.	1.000000	1.013096	-.1309619E-01
48.	1.450000	1.403136	.4686401E-01
49.	1.140000	1.062267	.7773266E-01
50.	1.000000	1.013096	-.1309619E-01

-2.0 0.0

R

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FILE WARD (CREATION DATE = 06 OCT 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-.250	0.0
53.	1.450000	1.403136	.46864610E-01		I
54.	1.720000	1.733675	-.13674751E-01		I
55.	1.190000	1.177354	.12646060E-01		I
56.	1.130000	1.062297	.67792066E-01		I
57.	1.190000	1.218771	-.28770731E-01		I
58.	1.190000	1.177354	.12646060E-01		I
59.	1.190000	1.218771	-.28770731E-01		I
60.	1.210000	1.207220	.27790161E-02		I

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 60.
NUMBER OF 2 S.D. OUTLIERS 2. OR 3.33 PERCENT OF THE TOTAL

VON NEUMANN RATIO 1.78173 DURBIN-WATSON TEST 1.75204

NUMBER OF POSITIVE RESIDUALS 18.
NUMBER OF NEGATIVE RESIDUALS 42.
NUMBER OF RUNS OF SIGNS 24.

EXPECTED NUMBER OF RUNS OF SIGNS 26.
EXPECTED S.D. OF RUN DISTRIBUTION 3.21501
UNIT NORMAL DEVIATE-
Z=(EXPECTED-OBSERVED)/S.D. -.52077
PROBABILITY OF OBTAINING .GE. ABS(Z) .29640

* * * * * * * * * * * * * * * * * * * M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. DESSS DESIGN REQUIREMENTS STANDARDS

MEAN RESPONSE 1.26100 STD. DEV. .61955

VARIABLE(S) ENTERED ON STEP NUMBER 1.. MISREQ MISSION REQUIREMENTS

MULTIPLE R	.79696	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.63519	REGRESSION	1.	14.15270	14.15270	100.96993	0
ADJUSTED R SQUARE	.62905	RESIDUAL	58.	8.13016	.14010		
STD DEVIATION	.37440	COEFF OF VARIABILITY	29.6 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
MISREQ	222.86211	22.177524	100.96993	.7969558
			.000	176.72698
(CONSTANT)	-221.69053	22.188666	99.823294	
			.000	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
OPCHAR	.76039	.80365	78.135257
			0
INTERFAC	.63064	.80867	37.037337
			0

* *

VARIABLE(S) ENTERED ON STEP NUMBER 2.. OPCHAR OPERATIONAL CHARACTERISTICS

MULTIPLE R	.91594	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFIC
R SQUARE	.84610	REGRESSION	2.	18.85356	9.42678	156.64706	0
ADJUSTED R SQUARE	.84070	RESIDUAL	57.	3.42930	.06016		
STD DEVIATION	.24520	COEFF OF VARIABILITY	19.4 PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
MISREQ	139.35745	16.207297	96.672500	.5040216
			0	126.23443
OPCHAR	1.7057472	.20315675	73.135257	.5123551

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANC
INTERFAC	-.42090	.04341	12.029413
			.001

FILE WARD (CREATION DATE = 04 OCT 78) WEAPON ACQUISITION REQUIREMENTS DATA

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. DERSS DESIGN REQ'T+SPEC STANDARDS

VARIABLE(S) ENTERED ON STEP NUMBER 3.. INTERFAC INTERFACE REQ'TS

MULTIPLE R	.93511	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.87442	REGRESSION	3.	19.48463	6.49488	129.97907	0
ADJUSTED R SQUARE	.86770	RESIDUAL	56.	2.79823	.04997		
STD DEVIATION	.22354	COEFF OF VARIABILITY	17.7 PCT				

------------------ VARIABLES IN THE EQUATION ------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
MISREQ	162.04024	14.789671	120.04076	.5735086
			0	120.36205
OPCHAR	3.7359706	.57648776	41.997827	1.0659079
			.000	3.41544
INTERFAC	-1.5208816	.42796063	12.629413	-.5026779
			.001	-1.40260
(CONSTANT)	-161.29744	14.713115	123.13564	
			.000	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANCE

ALL VARIABLES ARE IN THE EQUATION.

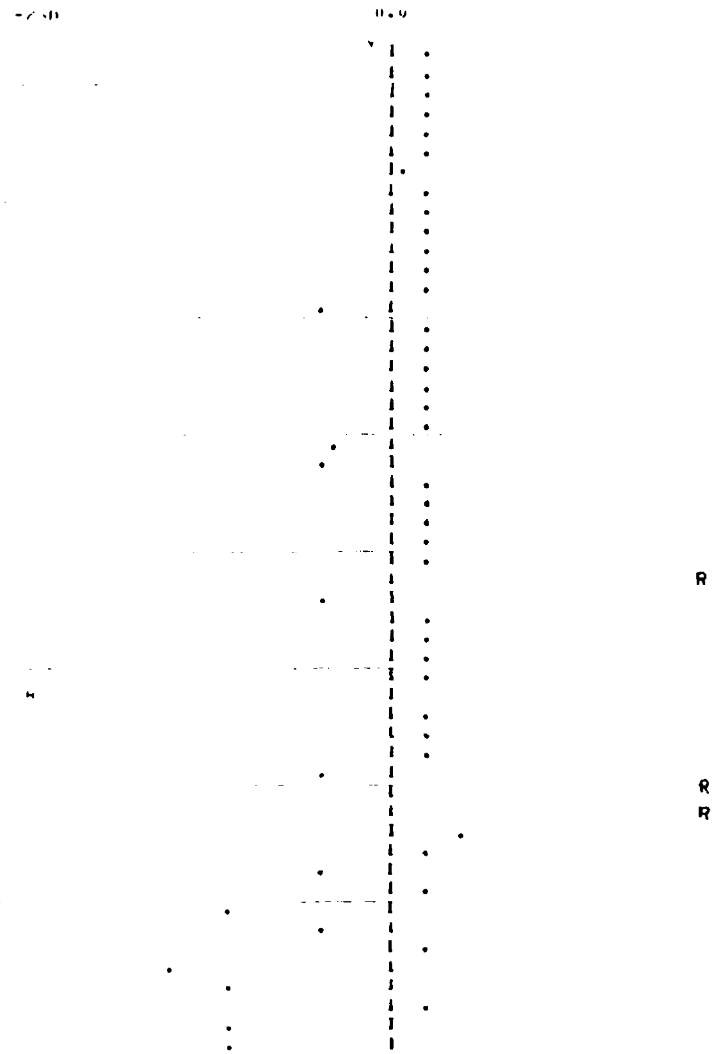
COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL
MISREQ	162.04024	14.789671	10.956311	132.41297 , 191.66752
OPCHAR	3.7359706	.57648776	6.4805731	2.5811270 , 4.8908143
INTERFAC	-1.5208816	.42796063	-3.5537045	-2.1781998 , -.66357342
CONSTANT	-161.29744	14.713115	-11.098301	-192.77335 , -131.82553

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

MISREQ	218.73431		
OPCHAR	-.73996	.33234	
INTERFAC	-.32283	-.23364	.18315
	MISREQ	OPCHAR	INTERFAC

OBSERVATION	Y VALUE	Y ESTIMATED	RESIDUAL
1.	1.000000	.9558940	.4410595E-01
2.	1.000000	.9558940	.4410595E-01
3.	1.000000	.9558940	.4410595E-01
4.	1.000000	.9558940	.4410595E-01
5.	1.000000	.9558940	.4410595E-01
6.	1.000000	.9558940	.4410595E-01
7.	1.070000	1.061649	.8351490E-02
8.	1.000000	.9558940	.4410595E-01
9.	1.000000	.9558940	.4410595E-01
10.	1.000000	.9558940	.4410595E-01
11.	1.000000	.9558940	.4410595E-01
12.	1.000000	.9558940	.4410595E-01
13.	1.000000	.9558940	.4410595E-01
14.	1.320000	1.396263	-.7626252E-01
15.	1.060000	1.022347	.3765320E-01
16.	1.000000	.9558940	.4410595E-01
17.	1.000000	.9558940	.4410595E-01
18.	1.000000	.9558940	.4410595E-01
19.	1.000000	.9558940	.4410595E-01
20.	1.000000	.9558940	.4410595E-01
21.	2.280000	2.352536	-.7253607E-01
22.	1.320000	1.396263	-.7626252E-01
23.	1.060000	1.022347	.3765320E-01
24.	1.000000	.9558940	.4410595E-01
25.	1.000000	.9558940	.4410595E-01
26.	1.000000	.9558940	.4410595E-01
27.	1.000000	.9558940	.4410595E-01
28.	2.240000	1.671600	.5683997
29.	1.320000	1.396263	-.7626252E-01
30.	1.060000	1.022347	.3765320E-01
31.	1.000000	.9558940	.4410595E-01
32.	1.000000	.9558940	.4410595E-01
33.	1.000000	.9558940	.4410595E-01
34.	1.660000	2.796790	-1.136790
35.	1.000000	.9558940	.4410595E-01
36.	1.000000	.9558940	.4410595E-01
37.	1.060000	1.022347	.3765320E-01
38.	1.320000	1.396263	-.7626252E-01
39.	2.240000	1.671600	.5683997
40.	1.760000	1.301354	.4586460
41.	1.100000	1.022347	.7765320E-01
42.	1.060000	1.022347	.3765320E-01
43.	1.320000	1.396263	-.7626252E-01
44.	1.000000	.9558940	.4410595E-01
45.	1.170000	1.365526	-.1955262
46.	1.320000	1.396263	-.7626252E-01
47.	1.000000	.9558940	.4410595E-01
48.	1.480000	1.753970	-.2739696
49.	1.170000	1.365526	-.1955262
50.	1.000000	.9558940	.4410595E-01
51.	1.060000	1.255640	-.1956404
52.	1.170000	1.365526	-.1955262



* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE..   INTERFAC   INTERFACE HEIGHT

MEAN RESPONSE   1.14617   STD. DEV.   .23[illegible]

VARIABLE(S) ENTERED ON STEP NUMBER 1..   OPCHAR   OPERATIONAL CHARACTERISTICS

MULTIPLE R	.95727	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	.91637	REGRESSION	1.	2.99736	2.99736	635.54797	0
ADJUSTED R SQUARE	.91[illegible]	RESIDUAL	58.	.27356	.00472		
STD DEVIATION	.06867	COEFF OF VARIABILITY	[illegible] PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
OPCHAR	1.0054472	.50991007E-01	635.54797	.957[illegible]
			0	1.2[illegible]
(CONSTANT)	-.20265023	.57835994E-01	25.603019	
			.000	

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANCE
DERSS	-.22046	.41493	2.9119940
			.093
FISREQ	.05100	.80365	.14957277
			.701

* *

VARIABLE(S) ENTERED ON STEP NUMBER 2..   DERSS   DESIGN REQUIREMENT STANDARDS

MULTIPLE R	.95919	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFIC
R SQUARE	.92044	REGRESSION	2.	3.01065	1.50533	329.70974	0
ADJUSTED R SQUARE	.91764	RESIDUAL	57.	.26024	.00457		
STD DEVIATION	.06757	COEFF OF VARIABILITY	5.[illegible] PCT				

-------------------- VARIABLES IN THE EQUATION --------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
OPCHAR	1.0[illegible]	.770367[illegible]E-01	117.1[illegible]	1.0[illegible]
			0	1.[illegible]
DERSS	-.37019[illegible]E-01	.22221810E-01	2.9119940	-.0[illegible]

---------- VARIABLES NOT IN THE EQUATION ----------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANCE
FISREQ	.38022	.29807	9.6691276
			.003

* M U L T I P L E   R E G R E S S I O N *

DEPENDENT VARIABLE.. INTERFAC INTERFACE REPORT

VARIABLE(S) ENTERED ON STEP NUMBER 1.. MISREQ [illegible]

MULTIPLE R	[illegible]	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFI
R SQUARE	[illegible]	REGRESSION	3.	3.04824	1.01607	255.59736	0
ADJUSTED R SQUARE	[illegible]	RESIDUAL	56.	.22262	.00398		
STD DEVIATION	.06305	COEFF OF VARIABILITY	[illegible] PCT				

------------------- VARIABLES IN THE EQUATION -------------------

VARIABLE	B	STD ERROR B	F / SIGNIFICANCE	BETA / ELASTICITY
OPCHAR	1.4929829	.8040542E-01	394.75179 / 0	1.1117906 / 1.45744
DERSS	-.1209978	.3404756E-01	12.62[illegible] / .001	-.3156126 / -.1[illegible]
MISREQ	21.044799	6.8407621	9.4641276 / .003	.1764417 / 1[illegible]
(CONSTANT)	-21.427719	6.8469364	9.78[illegible] / .003	

------------------- VARIABLES NOT IN THE EQUATION -------------------

VARIABLE	PARTIAL	TOLERANCE	F / SIGNIFICANCE

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
OPCHAR	1.4929829	.8040542E-01	18.56[illegible]	1.[illegible]	1.654[illegible]
DERSS	-.1209978	.3404756E-01	-3.55[illegible]	-.1[illegible]	-.5279235E-01
MISREQ	21.044799	6.8407621	3.0763[illegible]	7.3411055	34.74[illegible]
CONSTANT	-21.427719	6.8469364	-3.128[illegible]	-35.1[illegible]	-7.7[illegible]

VARIANCE/COVARIANCE MATRIX OF THE UNNORMALIZED REGRESSION COEFFICIENTS.

DERSS	.0011[illegible]		
MISREQ	-.1[illegible]	46.7[illegible]	
OPCHAR	-.[illegible]	.[illegible]	.006[illegible]

OBSERVATION	Y VALUE	Y ESTIMATED	RESIDUAL
1.	1.000000	.980646	.1093541E-01
2.	1.000000	.980646	.1093541E-01
3.	1.000000	.980646	.1093541E-01
4.	1.000000	.980646	.1093541E-01
5.	1.000000	.980646	.1093541E-01
6.	1.000000	.980646	.1093541E-01
7.	1.051000	1.056244	-.5243887E-02
8.	1.000000	.980646	.1093541E-01
9.	1.000000	.980646	.1093541E-01
10.	1.000000	.980646	.1093541E-01
11.	1.000000	.980646	.1093541E-01
12.	1.000000	.980646	.1093541E-01
13.	1.000000	.980646	.1093541E-01
14.	1.300000	1.306661	-.6661180E-02
15.	1.030000	1.026594	.3405790E-02
16.	1.000000	.980646	.1093541E-01
17.	1.000000	.980646	.1093541E-01
18.	1.000000	.980646	.1093541E-01
19.	1.000000	.980646	.1093541E-01
20.	1.000000	.980646	.1093541E-01
21.	1.310000	1.350610	-.2706[illegible]
22.	1.300000	1.306661	-.6661180E-02
23.	1.030000	1.026594	.3405790E-02
24.	1.000000	.980646	.1093541E-01
25.	1.000000	.980646	.1093541E-01
26.	1.000000	.980646	.1093541E-01
27.	1.000000	.980646	.1093541E-01
28.	1.680000	1.66[illegible]	.2152005E-01
29.	1.300000	1.306661	-.6661180E-02
30.	1.030000	1.026594	.3405790E-02
31.	1.000000	.980646	.1093541E-01
32.	1.000000	.980646	.1093541E-01
33.	1.000000	.980646	.1093541E-01
34.	1.420000	1.443[illegible]	-.6[illegible]E-01
35.	1.000000	.980646	.1093541E-01
36.	1.000000	.980646	.1093541E-01
37.	1.030000	1.026594	.3405790E-02
38.	1.300000	1.306661	-.6661180E-02
39.	1.680000	1.66[illegible]	.2152005E-01
40.	1.[illegible]	1.50[illegible]	.2707[illegible]
41.	1.030000	1.021756	.0[illegible]E-02
42.	1.030000	1.026594	.3405790E-02
43.	1.300000	1.306661	-.6661180E-02
44.	1.000000	.980646	.1093541E-01
45.	1.050000	1.16[illegible]	-.112[illegible]
46.	1.300000	1.306661	-.6661180E-02
47.	1.000000	.980646	.1093541E-01
48.	1.580000	1.60[illegible]	-.2[illegible]E-01
49.	1.050000	1.16[illegible]	-.112[illegible]
50.	1.000000	.980646	.1093541E-01

MULTIPLE REGRESSION OF [illegible]

FILE WARD (CREATION DATE = 04 OCT 76) [illegible] DATA

* M U L T I P L E   R E G R E S S I O N *

OBSERVATION	Y VALUE	Y ESTIMATE	RESIDUAL	-2SD	0.0
53.	1.580000	1.602020	-.22027990E-01		I
54.	2.070000	1.955114	.1190057		I
55.	1.270000	1.264471	.55285200E-02		I
56.	1.050000	1.162563	-.1125827		I
57.	1.260000	1.214652	.45347600E-01		I
58.	1.271000	1.265471	.55205200E-02		I
59.	1.260000	1.214652	.45347600E-01		I
60.	1.230000	1.23[illegible]	-.89621630E-02		I

NOTE - (*) INDICATES ESTIMATE CALCULATED WITH MEANS SUBSTITUTED
R INDICATES POINT OUT OF RANGE OF PLOT

NUMBER OF CASES PLOTTED 60.
NUMBER OF 2 S.D. OUTLIERS 2. OR 3.33 PERCENT OF THE TOTAL

VON NEUMANN RATIO 1.99977 DURBIN-WATSON TEST 1.96644

NUMBER OF POSITIVE RESIDUALS 44.
NUMBER OF NEGATIVE RESIDUALS 16.
NUMBER OF RUNS OF SIGNS 24.

EXPECTED NUMBER OF RUNS OF SIGNS 24.
EXPECTED S.D. OF RUN DISTRIBUTION 2.98930
UNIT NORMAL DEVIATE-
Z=(EXPECTED-OBSERVED)/S.D. .01115
PROBABILITY OF OBTAINING .GE. ABS(Z) .49555

BIBLIOGRAPHY

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VITA

Ronald Gene Blackledge was born on August 12, 1941 in Montgomery, Alabama. He graduated from college in 1964 with a degree in Aerospace Engineering from Texas A & M University where he also met and married Lillian Lois Howard. Upon graduation, he began a career as an Air Force officer. During the subsequent years, the Blackledge's had two sons, Kevin and Bryan. He has had Air Force tours in aircraft programs, a satellite project and a satellite tracking agency, and progressed during this time to the current rank of Major. Major Blackledge earned a Master's degree in management at the University of Southern California in 1969. He is a member of Beta Gamma Sigma and Phi Kappa Phi. After completion of the PhD program at The University of Texas at Austin, he will be a professor of management at the Graduate School of Logistics at Wright-Patterson Air Force Base in Dayton, Ohio.

Permanent address: Box 252-C, Star Route 3
Marble Falls, Texas 78654

This dissertation was typed by Betty L. Blackledge.

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LME